90039R01
2ND COPY

U.S. ARMY
MATERIEL COMMAND

— COMMITTED TO PROTECTION OF THE ENVIRONMENT —

DRAFT PUBLIC HEALTH RISK ASSESSMENT REPORT SUBMERGED QUENCH INCINERATOR TASK IRA-2 BASIN F LIQUIDS TREATMENT DESIGN

JANUARY, 1990

CONTRACT NO. DAAM15-88-D-0022/0001

VERSION 2.1

Woodward-Clyde Consultants

Consulting Engineers, Geologists and Environmental Scientists
Stanford Place 3, Suite 1000
4582 South Ulster Street Parkway
Denver, Colorado 80237
(303) 694-2770

90039R01
2ND COPY

DRAFT PUBLIC HEALTH RISK ASSESSMENT REPORT SUBMERGED QUENCH INCINERATOR TASK IRA-2 BASIN F LIQUIDS TREATMENT DESIGN

JANUARY, 1990

CONTRACT NO. DAAA15-88-D-0022/0001

VERSION 2.1

Prepared by:

WOODWARD-CLYDE CONSULTANTS

Prepared for:

U.S. ARMY PROGRAM MANAGER'S OFFICE

FOR ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	01/00/90	

4. TITLE AND SUBTITLE
PUBLIC HEALTH RISK ASSESSMENT REPORT, SUBMERGED QUENCH INCINERATOR, TASK IRA 2, BASIN F LIQUIDS, TREATMENT DESIGN, VERSION 2.1

5. FUNDING NUMBERS
DAAA15 88 D 0022

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
WOODWARD-CLYDE CONSULTANTS
DENVER, CO

8. PERFORMING ORGANIZATION REPORT NUMBER
90039R01

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
ROCKY MOUNTAIN ARSENAL (CO.). PMRMA
COMMERCE CITY, CO

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

THIS PUBLIC HEALTH RISK ASSESSMENT EVALUATES THE RISKS ASSOCIATED WITH THE ON-SITE INCINERATION OF BASIN F LIQUID AT RMA. THE POPULATIONS EVALUATED INCLUDE 1) ON-SITE WORKERS, 2) IRONDALE AS A POPULATION CENTER, 3) FENCELINE AT THE POINT OF HIGHEST EXPOSURE, AND 4) RESIDENCES AND SCHOOL THAT HAD THE HIGHEST MODELED EXPOSURES. THE RANGE OF CARCINOGENIC RISKS FOR THE POPULATIONS EVALUATED IS 3.26E-09 TO 4.55E-07. THESE RISKS ARE LESS THAN THE RANGE ACCEPTED BY THE EPA AT REMEDIATED SUPERFUND SITES. THE HAZARD INDEX (NONCARCINOGENIC TOXIC EFFECTS) VALUES RANGE FROM 2.47E-06 TO 3.69E-03 AND ARE NOT A CAUSE FOR CONCERN.

THE FOLLOWING STEPS IN PUBLIC HEALTH RISK ASSESSMENTS ARE DISCUSSED:

1. SELECTION OF INDICATOR CHEMICALS
2. SELECTION OF POTENTIALLY EXPOSED POPULATIONS
3. IDENTIFICATION OF POTENTIAL EXPOSURE PATHWAYS
4. ESTIMATION OF EXPOSURE CONCENTRATIONS

14. SUBJECT TERMS
AIR QUALITY, EXPOSURE PATHWAYS, INCINERATION

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED			

TABLE OF CONTENTS

LIST OF TABLES

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

1.0 SUMMARY

This report is a public health risk assessment to evaluate the health risks associated with the on-site incineration of Basin F liquid at the Rocky Mountain Arsenal (RMA). This risk assessment is site-specific to the RMA and to specific receptor populations and locations. The populations evaluated in this risk assessment include on-site workers, the fenceline at the point of highest exposure, the residences near the RMA property that had the highest modeled exposures, the school that had the highest modeled exposure, and Irondale as a population center.

This public health risk assessment demonstrates that the range of carcinogenic risks for the populations evaluated is 3.26E-09 to 4.55E-07. These risks were less than the range of risks that are acceptable by U.S. Environmental Protection Agency (EPA) policy at remediated Superfund sites. The noncarcinogenic toxic effects are expressed as a hazard index. A hazard index greater than one is cause for concern (U.S. EPA). The hazard index values for the populations evaluated ranged from 2.47E-06 to 3.69E-03 and are not a cause for concern.

This health risk assessment was conducted following U.S. EPA guidelines as recommended in the Superfund Public Health Evaluation Manual (SPHEM) (U.S. EPA), 1986) and the Superfund Exposure Assessment Manual (SEAM) (U.S. EPA, 1988a). The major steps in public health risk assessments in SEAM are selection of indicator chemicals, selection of potentially exposed populations, identification of potential exposure pathways, estimation of exposure concentrations, estimation of chemical intake, assessment of chemical toxicity, and characterization of the potential health risks associated with estimated exposures. Each of these health risk assessment steps is discussed in this report.

It is often necessary to make assumptions to evaluate a health risk. The most important assumptions of this risk assessment are stated and discussed in the appropriate sections of this report. These assumptions are conservative in that they may overestimate the health risk and are, therefore, protective of public health.

2.0 INDICATOR CHEMICALS

The selection of indicator chemicals is the first step in a health risk assessment. The objective of selecting indicator chemicals is to identify a subset of chemicals that represent those chemicals that are the most toxic, environmentally mobile, environmentally persistent, and that are found at the highest concentrations at the site. The EPA procedure as described in SPHEM was designed to identify those chemicals. The indicator chemicals represent the degree of risk from all chemicals present and include all chemicals which pose the most significant health risks.

The first step in selecting indicator chemicals is to identify the potentially toxic chemicals and their concentrations in the stack emissions from pilot incinerator tests. In this risk assessment all chemicals identified in the stack emissions were considered. After all chemicals are identified, an indicator score must be calculated for each chemical. The indicator score is the product of the chemical concentration and a chemical-specific toxicity constant. The chemical concentrations used to calculate the indicator score were specific to the media, air and soil deposition, and were the maximum concentrations obtained by air modeling. The air model used was the Industrial Source Complex (ISC) model recommended in SEAM. Toxicity constants have been derived by EPA, are dependent on the exposure medium and the human exposure route, and are available for both inhalation and ingestion routes. Indicator scores were calculated using air and soil toxicity constants because these are the most important exposure media. The air and soil toxicity constants of each chemical for which a toxicity constant is available (SPHEM, 1986) were multiplied by the highest modeled concentration of the respective chemical. The maximum concentrations were used to ensure a conservative result. The resulting indicator scores (the highest of the two pathways, inhalation and ingestion) were used to rank the chemicals emitted from the stack. The inhalation pathway resulted in the highest indicator score for each chemical. Potential carcinogenic and noncarcinogenic indicator chemi-

cals were scored and selected independently because they have different toxic mechanisms. Potential carcinogens also exhibit noncarcinogenic effects and, therefore, were also ranked on the basis of their noncarcinogenic effects when EPA toxicity constants were available. The air and soil toxicity constants, maximum measured concentrations, and resulting indicator scores for potential carcinogenicity and noncarcinogenic toxicity of stack emission chemicals are presented in Tables 2-1 and 2-2. Although they were not detected during the stack gas monitoring, dioxins and pentachlorodibenzofurans were included as indicator chemicals because they are potent carcinogens and are potential products of incineration or combustion processes. Dieldrin, arsenic, and antimony were also not detected in the stack emissions but were included because they were detected in Basin F liquid, and are considered potentially significant. The indicator chemical selection process is not supposed to contravene professional judgment and the inclusion of these chemicals results in more defensible risk assessment conclusions.

In addition to the indicator score, the physical, chemical, and subsequent environmental fate properties must also be considered. Those chemicals that do not have high indicator scores were carefully examined to identify any physical, chemical, and subsequent environmental fate properties that are important and may affect the chemicals' impact on public health. These properties are listed in Table 2-3 for all chemicals that were detected and for which data were available. These data were taken from SPHEM.

Although there are other important chemical and physical properties that can affect exposures, U.S. EPA (SPHEM) focuses on the parameters listed in Table 2-3. Some properties have different implications for different exposure pathways. A brief description of the relevance of each property to potential chemical release, transport, and site is given below:

- Water solubility. This is the maximum amount of chemical that can dissolve in water under specified conditions. Although it is not important in the exposure pathways in this risk assessment, highly soluble chemicals can be rapidly leached from wastes and contaminated soil and are generally mobile in ground water. Water solubility is especially important in the evaluation of aquatic exposure pathways.

- Vapor pressure and Henry's Law constant. These are two measures of chemical volatility and are important in evaluating air exposure pathways. Vapor pressure is most directly relevant to chemical releases to air from spills or contaminated surface soils. Henry's Law Constant is more appropriate for evaluating releases to air from contaminated water.

- Organic Carbon Partition Coefficient (Koc). This is a measure of the relative sorption potential for organics. It indicates the tendency of an organic chemical to be adsorbed on soil. A low Koc indicates that the chemical may be leached and contaminate ground or surface water. A high Koc indicates that the chemical is strongly adsorbed and may contaminate stream sediment, soil, or airborne particulate.

- Log Kow and Fish BCF. These parameters indicate the potential for chemicals to bioaccumulate in the food chain. A high potential for bioaccumulation is very important for specific pathways.

The final indicator chemical list is presented in Table 2-4. The first nine potential carcinogens were selected as indicator chemicals. This list includes four metals and five organic compounds. Two additional compounds were selected as indicator chemicals based on their presence in the stack gas, and on toxicological, chemical, physical, and environmental fate properties. These were dichloromethane and furans. Dichloromethane and

furans are not included in Table 2-1, Calculation of Indicator Scores for Potential Carcinogens, because the U.S. EPA has not yet determined toxicity criteria for indicator score calculation. Because these chemicals do have carcinogenic potency factors they are included as indicator chemicals in Table 2-4. The inclusion is based on professional judgment. Seven noncarcinogens were selected as noncarcinogenic indicator chemicals.

TABLE 2-1

CALCULATION OF INDICATOR SCORES
FOR POTENTIAL CARCINOGENS

Chemical	sTc*	aTc*	Concentration Soil mg/kg	Concentration Air mg/m^3	Indicator Score	Rank
Aldrin	9.40E-05	1.88E+01	2.475E-04	4.88E-09	9.174E-08	7
+Arsenic	2.03E-04	4.07E+01	5.867E-02	1.158E-06	4.713E-05	1
Benzene	3.86E-07	7.71E-02	- -	2.556E-07	1.971E-08	10
+Beryllium	NA	2.28E+01	1.468E-03	2.898E-08	6.607E-07	5
Bis(ethylhexyl)pthalate	2.86E-08	5.71E-03	1.027E-01	2.028E-06	1.158E-08	11
Cadmium	NA	1.65E+01	6.381E-02	1.260E-06	2.079E-05	2
Carbon Tetrachloride	9.41E-05	1.88E+01	- -	4.081E-07	7.672E-06	4
Chloroform	2.81E-06	5.63E-01	- -	1.160E-07	6.531E-08	8
Chromium VI	NA	1.11E+02	5.812E-03	1.147E-07	1.273E-05	3
+DDE	5.64E-06	1.13E+00	2.138E-04	4.220E-09	4.769E-09	13
+DDT	7.97E-06	1.59E+00	2.138E-04	4.220E-09	6.710E-09	12
Methylene Chloride	NA	NA	- -	3.934E-06	-	
+Dieldrin	1.83E-04	3.66E+01	2.138E-04	4.220E-09	1.545E-07	6
+Dioxin	1.71E-01	3.43E+04	9.300E-08	1.8366E-12	6.297E-08	9

* Data from Exhibit A-3 SPHEM: sTc = Toxicity Constant in Soil; aTc = Toxicity Constant in Air
\+ Not Detected in Stack Gas Emissions. Included to Ensure That Health Risks Are Not Underestimated

TABLE 2-2

CALCULATION OF INDICATOR SCORES
FOR NONCARCINOGENS

Chemical	sTc*	aTc*	Concentration Soil mg/kg	Concentration Air mg/m^3	Indicator Score	Rank
Aldrin	--	--	1.867E-02	4.88E-09	5.314E-15	20
+Antimony	2.17E-04	2.29E+02	1.914E-01	3.092E-06	7.081E-04	1
Barium	2.04E-04	4.08E+01	--	3.779E-06	1.542E-04	5
Benzene	5.85E-06	1.18E+02	1.468E-03	2.556E-07	3.016E-05	9
+Beryllium	--	1.45E+04	1.027E-01	2.998E-08	4.347E-04	3
Bis(ethylhexyl)pthalate	--	--	1.027E-01	2.028E-06	9.164E-10	18
Cadmium	2.23E-04	3.59E+02	6.381E-02	1.260E-06	4.523E-04	2
Carbon Tetrachloride	1.59E-05	3.17E+00	--	4.081E-07	1.294E-06	13
Chloroform	--	2.37E+01	--	1.160E-07	2.749E-06	12
Chromium III	--	--	5.812E-03	1.147E-07	--	
Chromium VI	--	2.50E+01	5.812E-03	1.147E-07	2.868E-06	11
Copper	3.57E-05	7.14E+00	2.106E-04	4.157E-05	2.968E-04	4
+DDE	--	--	2.138E-04	4.220E-01	--	
+DDT	--	--	2.138E-04	4.220E-01	--	
Dibutyl Pthalate	1.90E-06	3.81E-01	1.385E-01	2.734E-06	1.042E-06	14
Methylene Chloride	4.60E-08	9.20E-03	--	3.934E-06	3.619E-08	16
+Dieldrin	--	--	2.138E-04	4.220E-09	--	

TABLE 2-2
(Continued)

Chemical	sTc*	aTc*	Concentration Soil mg/kg	Concentration Air mg/m^3	Indicator Score	Rank
Ethylbenzene	5.52E-07	1.10E-01	--	4.783E-06	5.261E-07	15
Furan	--	--	5.367E-06	1.836E-12	--	
Iron	--	--	3.475E-01	6.861E-06	--	
Lead (Inorganic)	4.46E-05	8.93E+00	2.030E-01	4.008E-06	3.579E-05	8
Mercury (Inorganic)	9.21E-04	1.86E+02	3.715E-02	7.33E-07	1.363E-04	7
Nickel	2.13E-04	1.57E+02	4.689E-02	9.256E-07	1.453E-04	6
Silver	1.00E-03	2.00E+02	2.948E-03	5.819E-08	1.164E-05	10
Thallium	--	-	5.867E-02	1.158E-06	--	
Toluene	2.60E-07	5.20E-02	--	6.858E-07	3.566E-08	17
1,1,1 Trichloroethane	3.67E-08	7.33E-03	--	3.129E-08	2.294E-10	19
Xylene	--	--	--	1.790E-06	--	

* Data from Exhibit A-5 SPHEM
  sTc = Toxicity Constant in Soil
  aTc = Toxicity Constant in Air
+ Not Detected in Stack Gas Emissions. Included to Ensure That Health Risks Are Not Underestimated

TABLE 2-3
PHYSICAL, CHEMICAL AND FATE DATA

Chemical Name	Mole Weight (g/mole)	Water Solubility (mg/l)	Vapor Pressure (mm Hg)	Henry's Law Constant ($atm\text{-}m^3/mol$)	Koc[1] (ml/g)	Log Kow[2]	Fish BCF[3] (l/kg)
Aldrin	365	1.80E-01	6.00E-06	1.60E-05	96000	5.30	28
+Antimony and Compounds	122		1.00E+00	NA			1
+Arsenic and Compounds	75		0.00E+00	NA			44
Barium and Compounds	137			NA			
Benzene	78	1.75E+03	9.52E+01	5.59E-03	83	2.12	5.2
+Beryllium and Compounds	9		0.00E+00	NA			
Bis(2-ethylhexyl)phthalate (BEHP)	391						
Cadmium and Compounds	112		0.00E+00	NA			81
Carbon Tetrachloride	154	7.57E+02	9.00E+01	2.41E-02	110	2.64	19
Chloroform	119	8.20E+03	1.51E+02	2.87E-03	31	1.97	3.75
Chromium III and Compounds	52		0.00E+00	NA			16
Chromium VI and Compounds	52		0.00E+00	NA			16
Copper and Compounds	64		0.00E+00	NA			200
+DDE	318	4.00E-02	6.50E-06	6.80E-05	44000000	7.00	51000
+DDT	355	5.00E-03	5.50E-06	5.13E-04	243000	6.19	54000
Dibutyl Phthalate	278	1.30E+01	1.00E-05	2.82E-07	170000	5.60	
+Dieldrin	381	1.95E-01	1.78E-07	4.58E-07	1700	3.50	4760
Ethylbenzene	106	1.52E+02	7.00E+00	6.43E-03	1100	3.15	37.5
Furan	68						
Iron and Compounds	56			NA			
Lead and Compounds (inorganic)	207		0.00E+00	NA	76	0.99	
Mercury and Compounds (inorganic)	201		2.00E-03	NA			5500
Methylene Chloride	85	2.00E+04	3.62E+02	2.03E-03	8.8	1.30	5
Nickel and Compounds	59		0.00E+00	NA			47
+2,3,7,8-TCDD (Dioxin)	322	2.00E-04	1.70E-06	3.60E-03	33000000	6.72	5000
Silver and Compounds	108		0.00E+00		NA		3080
Thallium and Compounds	204		0.00E+00				
Toluene	92	5.35E+02	2.81E+01	6.37E-03	300	2.73	10.7
1,1,1-Trichloroethane	133	1.50E+03	1.23E+02	1.44E-02	152	2.5	5.6
Xylene (mixed)	106	1.98E+02	1.00E+01	7.04E-03	240	3.26	

(1) Koc = Organic carbon-based partition coefficient
(2) Kow = Octanol/water partition coefficient
(3) BCF = Bioconcentration Factor
+ Not Detected in Stack Gas Emissions. Included to Ensure That Health Risks Are Not Underestimated

Source: SPHEM (U.S. EPA, 1986)

TABLE 2-4

SELECTED INDICATOR CHEMICALS

Potential Carcinogens

+Arsenic
Cadmium
Chromium VI
Carbon Tetrachloride
Beryllium
+Dieldrin
Aldrin
Chloroform
+Dioxins (Tetrachlorodibenzo-p-dioxins, Petachlorodibenzo-p-dioxins, Hexachlorodibenzo-p-dioxins)

Additional Potential Carcinogens - No Indicator Score

Methylene Chloride
Furans (Tetrachlorodibenzofurans, Pentachlorodibenzofurans, Hexachlorodibenzofurans)

Noncarcinogens

+Antimony
Cadmium
+Beryllium
Copper
Barium
Nickel
Mercury (Inorganic)

+ Not Detected in Stack Gas Emissions. Included to Ensure That Health Risks Are Not Underestimated

3.0 EXPOSURE PATHWAYS

The second step in the risk assessment is to identify potential exposure pathways. An exposure pathway consists of five necessary elements: 1) a source and mechanism of chemical release to the environment, 2) an environmental transport medium (e.g., air, soil, ground water), 3) an exposure point (a point of potential human contact with the contaminated medium), 4) confirmation that chemical concentrations exist at the exposure point, and 5) a human intake route at the exposure point (e.g., inhalation of stack gases). Each of these exposure pathway elements is discussed below. When an exposure pathway is missing any element, that exposure pathway is incomplete. Incomplete exposure pathways do not result in exposure to humans, and as a result there is no health risk from incomplete exposure pathways.

3.1 SOURCE OF CHEMICAL RELEASE

The source and chemical release mechanisms evaluated in this risk assessment are the stack emissions from the incineration process. The stack emissions are released into the air. Specific chemicals in the stack emissions are the result of incomplete destruction or are products of combustion. In the first case, incomplete destruction, the chemicals emitted would be those present in the Basin F liquid. In the second case, combustion products or partial combustion products are chemicals that may not be present in Basin F liquid.

The incinerator has been designed to treat 800 gallons per hour (8,276 pounds per hour) in order that the entire 8.5 million gallons of Basin F liquids can be treated within approximately 1.5 years. The maximum concentration of each indicator chemical is assumed to be the highest measured concentration in the stack gas pilot incineration test. The emission rate is the rate at which a chemical is released into the environment from the incineration. After the chemical is released, it is assumed to be dispersed into the air and blown downwind. The concentration

downwind can be predicted using air dispersion modeling. The incinerator was assumed to be located approximately at the Basin F site.

3.2 ENVIRONMENTAL TRANSPORT

The primary environmental transport medium is air. The exposure pathway in this risk assessment is a release of stack emissions to the atmosphere, environmental transport of the chemicals to the exposure point, and then inhalation of the contaminated air. Two secondary (or indirect) exposure pathways are the deposition of chemicals from the atmosphere onto soil and vegetables at the exposure points, followed by ingestion of vegetables and soil. Other environmental exposure pathways include deposition onto surface waters, leaching of soil-deposited particulate into surface or ground water, and subsequent ingestion. These latter pathways are not significant and do not merit further consideration.

3.3 EXPOSURE POINTS

Exposure points are an important element of any exposure pathway. An exposure point is that point where humans may actually contact the contaminated medium. Different exposure pathways may have different exposure points. The exposure points used in this risk assessment are those points where the public can be exposed to the contaminants.

Five exposure points were selected for use in this public health risk assessment. One of the exposure points was selected to evaluate the potential health impacts for workers who may be present on Rocky Mountain Arsenal property. The on-site exposure point was selected as the area of maximum impact or highest contaminant concentrations based on air dispersion modeling. Four other exposure points were selected to represent the potential exposures experienced by the public. The selection of the four public exposure points discussed, on public areas that had the highest impact, were areas of special interest, or contained sensitive populations (schools).

The four areas of public exposure, shown as locations 2 through 5 on Figure 1, were

- Locations at the fenceline boundary of the Rocky Mountain Arsenal where the modeled concentrations of emissions was the highest.

- The Irondale residential area, located west and west-southwest of Basin F, was selected as a special interest area.

- Individual residences located outside the fenceline boundaries of RMA which were projected to receive the highest emission concentrations determined by modeling were selected.

- The air impacts were modeled for several nearby schools, including DuPont School, Monaco School, Hanson School, and Derby School. The Hanson School had the highest modeled concentrations and was used in the risk assessment. School locations were selected as sensitive population receptor points as recommended in SPHEM.

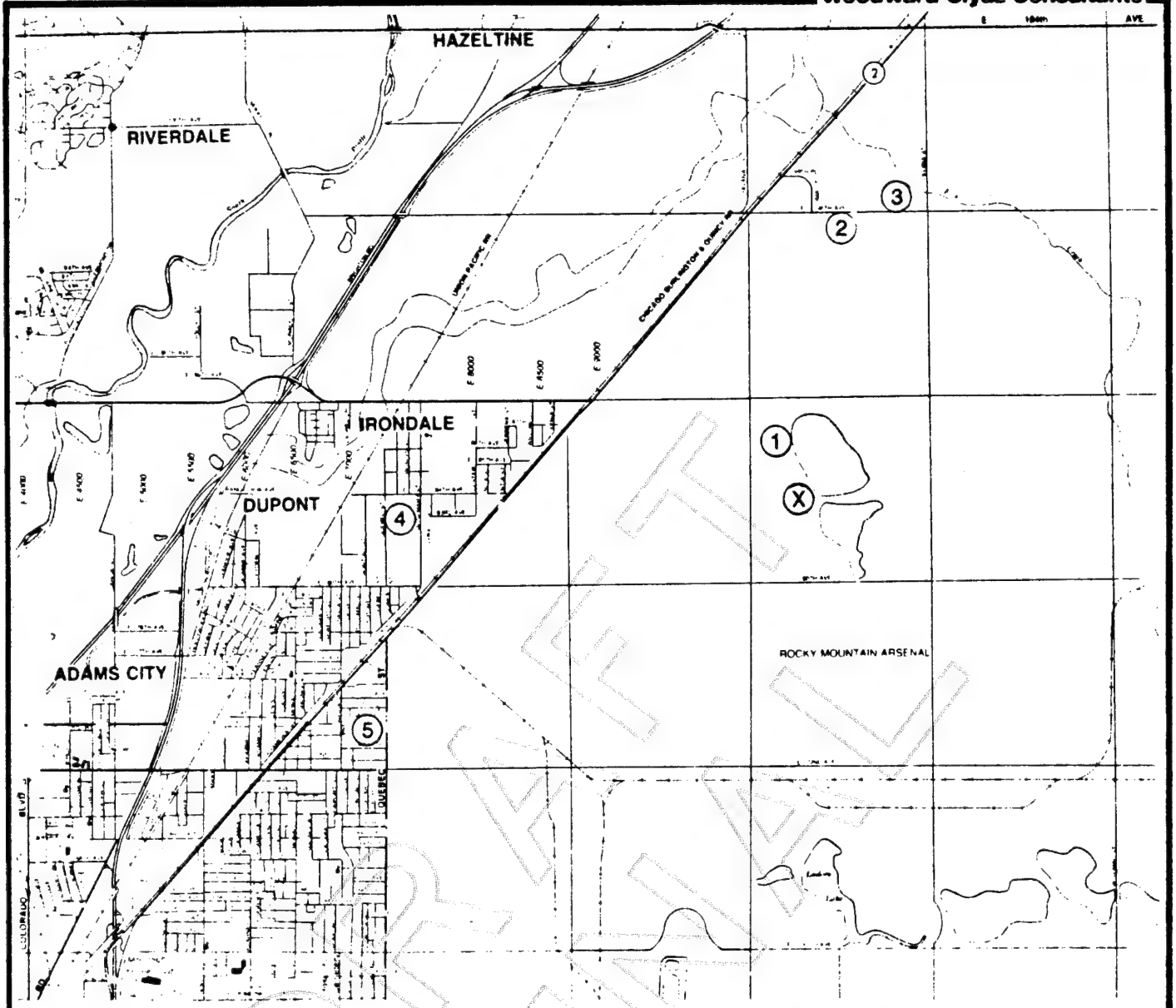
3.4 ESTIMATION OF EXPOSURE POINT CONCENTRATIONS

The next step in the risk assessment process is to calculate the indicator chemical concentrations at the exposure points. Exposure point concentrations were estimated using accepted air dispersion modeling techniques. The air modeling is described in Section 4.0.

3.5 HUMAN INTAKE

In this risk assessment the intake of incineration-related chemicals was evaluated by the inhalation and ingestion routes. The inhalation intake route is a direct exposure to chemicals in the air. The ingestion route evaluated in this risk assessment is an indirect exposure route. The deposition of particulates from the incinerator stack gas was modeled to

the receptor points and assumed to deposit on soil and vegetable gardens. The incidental ingestion of contaminated soil and the ingestion of home-grown vegetables were evaluated as human intake routes. Human intakes are discussed in detail in Section 5.0.



LEGEND

- (X) ASSUMED LOCATION OF SUBMERGED QUENCH INCINERATOR
- (1) ON-SITE RECEPTORS
- (2) FENCELINE RECEPTORS
- (3) NEAREST RESIDENTIAL RECEPTORS
- (4) IRONDALE RECEPTORS
- (5) NEAREST SCHOOL (HANSON ELEMENTARY SCHOOL)

N

0 1/2 1 2

SCALE IN MILES

Job No. : 22206	LOCATION OF RECEPTOR POINTS
Prepared by: J.A.T.	
Date: 1/8/90	

FIG. 1

4.0 AMBIENT AIR QUALITY IMPACTS

This section contains a description of the approach and results of assessing impacts from ambient air dispersion and deposition of stack emissions of various volatiles, semivolatiles, and metals. The modeling approach is conservative and may overestimate actual exposure. For example, the air modeling assumed that all chemicals remained in the air and would be inhaled; and the deposition model assumed that all semi-volatile organic compounds and metals would be deposited on soil or vegetables.

4.1 AIR DISPERSION MODELING

Air dispersion modeling is a process that predicts the contaminant concentration in air at any chosen point or distance from a source. A receptor grid was generated to assure the identification of the maximum concentration at various locations of public and on-site exposure. Air dispersion models use wind and temperature data to calculate the concentration as a function of distance and direction from the source. The ambient air impacts of a remedial process scenario using a submerged quench incinerator was assessed by modeling air emissions with the Industrial Source Complex (ISC) model approved by the EPA (1987). The ISC model was used to generate summary tables of maximum ambient air impacts for averaging periods of eight hours and one year. These data were used to calculate contaminant concentrations, and are presented in Tables 4-1 to 4-5. The maximum concentrations/emission values (denoted by the symbol chi/q) are key values computed by the model.

The following assumptions were used in the air quality modeling of the incinerator stack emissions:

- Air emissions originate from only one stack source.

- One year of hourly meteorological data from Stapleton International Airport for the calendar year 1988 was assumed to be representative of potential dispersion conditions at the Basin F site; mixing heights were input according to seasonal averages during the morning and afternoon as depicted by Holzworth (Holzworth, 1972); comparison of 1988 to long-term (1960-1964) distributions of stability class and wind direction indicate that the occurrence of stability conditions and wind flow conducive to worst-case impacts at sensitive areas of exposure are just as great or greater for 1988 than for a long-term period such as 1960-1964.

- Wind speed for any given hour was not allowed to be less than one meter per second per modeling guidelines cited in "Guideline on Air Quality Models" (EPA, 1986)

The chi/q value occurring at the exposure point is multiplied by the emission rate to determine the contaminant concentration at the exposure point.

Five exposure areas were examined for potential ambient air impacts:

- Fenceline
- On-site
- Nearby schools
- Irondale residential area
- Individual residences

Estimation of Ambient Air Concentration

The air concentration of a particular compound in ambient air resulting from the emissions of the RMA submerged quench incinerator stack is predicted by the formula:

Concentration in Ambient Air (C_{air}) =

Emission Rate x Chi/Q x Unit Conversion Factor

Where: C_{air} = Compound Concentration in Ambient Air (kg/m^3)

Emission Rate = Rate of chemical release from process (g/sec)

Chi/q = Ambient Air Dispersion Modeling factor $(\frac{mg/m^3}{g/sec})$

Unit Conversion Factor = 1E-06 kg/mg

The emission rate (ER) for each compound is based on pilot test results and scaled upward by a factor approximately equal to the ratio of the projected feed rate of the Basin F liquid to the feedrate of the pilot scale submerged quench incinerator. Emission rates for several compounds present in the Basin F liquid, but not in the pilot test air sample stream, were estimated by assuming that these compounds were present in the pilot test air sample stream at the laboratory detection limit.

Source sampling of a pilot scale submerged quench incinerator was performed in February, 1989 using appropriate U.S. EPA methods to quantify the presence of particulate, volatile organic compounds, semi-volatile organic compounds, and metals in the air emission stream of the incinerator stack. Lab analyses of each of the source samples provided an estimate of the mass of each compound collected during a sample run. Compound emission rates were obtained by dividing the analyzed mass by the sample volumes and then multiplying by the volumetric flow rates. For each compound detected, the highest value from a set of samples was selected to estimate an emission rate if more than one sample run for a set of compounds had been performed. Each of the compound emission rates calculated for the pilot scale incinerator was scaled to the RMA submerged quench incinerator stack

by multiplying by the approximate ratio of the RMA stack to pilot stack volumetric flow rates. This ratio ranged from 30 to 35.

Several compounds were not detected in the pilot submerged quench incinerator stack sample stream, but have been detected in the Basin F liquid. These compounds included Dieldrin, 4,4'-DDT, 4,4'-DDE, arsenic, antimony, and beryllium. In order to ensure that those highly toxic chemicals were adequately considered in evaluating the risks, they were assumed to occur in the stack emissions at the laboratory detection limit.

The exposure concentrations can be estimated by assuming the compounds are present at the detection limit in the stack gas or that they are removed to the levels predicted in the design (destruction and/or removal efficiency). A comparison of these two approaches is made in the following table:

Chemical	Air Concentration Based On Detection Limit	Air Concentration Based On Destruction Efficiency*
Arsenic	4.98E-08	4.84E-08
Antimony	3.09E-06	1.54E-07
Dieldrin	1.81E-10	2.78E-12

*These values were taken from the preliminary risk assessment. All concentrations are for the point of maximum impact and are in mg/m^3.

As expected, the destruction efficiency approach results in lower concentrations than the detection limit approach. The comparison does indicate that "detection limit" concentrations in the emissions are similar to destruction efficiency values for arsenic and antimony.

To obtain maximum estimates of ambient air quality impacts and ambient deposition impacts, compound emissions in gaseous or airborne particulate form and as particulate subject to deposition were treated independently. Particle-sizing data for those compounds occurring as particulate for purposes of deposition estimates can only be applied if the fraction of a particular compound emission as particulate is known. Volatile compounds are not likely to occur as particulate, while metals evaluated are likely to occur totally as particulate. However, semivolatiles could occur either in gaseous or particulate state. Fractionation data on semivolatiles in gaseous and particulate form are not readily available. Due to this limitation, the ambient air quality modeling approach conservatively assumed all compound emissions to be airborne at all times. The ISC model treats airborne dispersion of a gas or particulate identically as long as deposition is not incorporated. This eliminates the need to partition each compound into airborne particulate and gaseous states.

Since estimation of ambient deposition impacts requires specifying the fraction of an emitted compound which is particulate, both semivolatiles and metals were assumed to occur totally as particulate using generic particle size distribution data to obtain maximum ambient deposition estimates for those compounds.

In summary, the following approach was utilized to estimate airborne and deposition emission rates for each compound:

1. All identified volatiles, semivolatiles, and metals were assumed to be totally airborne (gaseous or particulate) in modeling ambient air quality impacts.

2. All identified semivolatiles and metals were assumed to occur in particulate form subject to deposition in modeling ambient deposition impacts; volatiles were assumed to not likely occur in particulate form.

The following example calculates the maximum annual average concentration for the organic compound methylene chloride, at an on-site receptor.

Assuming that:

C_{air} (methylene chloride) = ER x Chi/q x Unit Conversion Factors

Where: ER = 2.93E-04 g/sec (for methylene chloride)

Chi/q = 5.80E-04 $\frac{mg/m^3}{g/sec}$

Unit Conversion Factor: 1E-06 kg/mg

Solving

C_{air} (methylene chloride) =

(2.93E-04 g/sec) x ($\frac{5.8E-04\ mg/m^3}{g/sec}$) x (1E-06 kg/mg)

= 1.69E-13 kg/m^3

For each compound and averaging period, ambient air concentrations were calculated by multiplying the compound emission rate by the appropriate maximum chi/q and by a unit conversion factor.

4.2 AIR DEPOSITION MODELING

Air deposition modeling is a process that predicts concentration of contaminants deposited on a surface at any chosen distance and direction from a source. Deposition modeling predicts the rate at which the contaminant settles out of the air and is deposited on the ground. This allows a concentration on surface soil or vegetables to be calculated.

Total annual deposition from the submerged quench incinerator was calculated with ISCLT, the long-term version of ISC. A "chi/q" (concentration/emission rate) approach was again followed with emissions from the stack source assumed to be 1 gram per second for one year (i.e., 31,536,000 grams) with resultant deposition predictions expressed as grams per square meter. Particle size distribution and corresponding fall velocities were input according to generic values found in the EPA publication AP-42 (U.S. EPA, 1985) and from acid deposition research (Galloway et al., 1980).

The highest annual average maximum chi/q values for each public and on-site exposure area are presented in Tables 4-6 to 4-10. The emission rate of each constituent is multiplied by the modeled annual deposition to obtain the annual constituent deposition at a particular exposure point.

The following assumptions were used in the deposition modeling process:

- Air emissions originate from one stack source.

- One year of hourly meteorological data from Stapleton International Airport for the calendar year 1988 was assumed to be representative of potential dispersion conditions at the Basin F site based on the reasoning presented in Section 4.1. Statistical summaries of wind speed, wind direction, and stability class were computed with mixing height and temperature assignments consistent with the recommendations described in the ISC user's manual (U.S. EPA, 1987).

- For worst-case (maximum) estimates of annual deposition, all particulates were assumed to be retained on the ground or vegetable surface once it was deposited.

The chemical concentrations in soil and vegetables are calculated using the maximum deposition rate.

The five exposure areas examined for potential ambient air impacts were also examined for potential ambient deposition impacts.

4.2.1 Estimation of Soil Concentration

The contaminant concentration in soil is predicted by the formula:

Compound Concentration in Soil (C_{soil}) =

$$\frac{\text{Emission Rate} \times \text{Chi/Q} \times \text{Deposition Duration} \times \text{Unit Conversion Factors}}{\text{Weight of mixing soil per unit area}}$$

Where: C_{soil} = Compound Concentration in Soil (mg/kg)

Emission Rate = Rate of chemical release from process (g/sec). Calculated the same as for C_{air}.

Chi/q = Air Deposition Modeling Factor $(\frac{g/m^2/yr}{g/sec})$

Duration = 18 months (1.5 years)

Unit Conversion Factors = 1E-03 kg/g x 1E+06 mg/kg

Weight of mixing soil = Calculated as 6.6 kg/m^2 assuming a per unit area soil thickness of 0.25 inch

Compound concentration in soil (C_{soil}) is expressed as mg/kg. C_{soil} is similar to that for air in that it includes the stack emissions, a Chi/Q, and unit conversion factors. The C_{soil} differs from that of air in that the chi/q factor is a deposition factor instead of a dispersion factor. Also, the duration of remedial operations is expected to last 18 months.

Contaminants can be expected to mix with the first one-half to one-quarter inch of undisturbed soil, with the more conservative one-quarter inch of soil used in the calculations. The weight of surface soil is reported to range from 1,040 to 1,602 kg/m^3. The weight of the mixing soil in one square meter is 6.6 kg (0.25 in x 1m/39.37 in x 1 m^2 x 1,040 kg/m^3).

The following example calculates the C_{soil} for an organic compound, Aldrin, for the incinerator.

Assuming that:

Emission rate = 3.64E-07g/sec (same as for air)

Duration = 1.5 years

$$\text{Chi/Q} = 2.989 \ \frac{g/m^2/yr}{g/sec}$$

Unit Conversion Factor = 1.00E-03 kg/g x 1.00E+06 mg/kg

$$\frac{\text{Weight of mixing soil}}{\text{per unit area}} = 6.6 \text{ kg/m}^2$$

Solving:

C_{soil} (Aldrin) =

$$\frac{(3.64E\text{-}07 \text{ g/sec}) \times (2.989 \ \frac{g/m^2/yr}{g/sec}) \times (1.5 \text{ yr}) \times (1E\text{-}03 \text{ kg/g})(1E+06 \text{ mg/kg})}{(6.6 \text{ kg/m}^2)}$$

= 2.47E-04 mg/kg

For each compound subject to deposition, the soil concentration over a 1.5 year period was estimated within a particular exposure area by multiplying the compound emission rate (assumed as particulate), appropriate maximum annual Chi/Q, and unit conversion factors divided by the soil weight per unit area.

4.2.2 Estimation of Vegetable Concentration

The contaminant concentration in vegetables is predicted by the formula:

$$\text{Compound Concentration in Vegetables } (C_{veg}) = \frac{\text{Emission Rate} \times \text{Chi/Q} \times \text{Deposition Duration} \times \text{Removal by Washing} \times \text{Unit Conversion Factors}}{\text{Weight of Vegetable/Surface Area}}$$

Where: C_{veg} = Compound Concentration in vegetables (mg/kg)

ER = Emission Rate of chemical release from process (g/sec). Calculated the same as for C_{air} and C_{soil}.

Chi/q = Air deposition modeling factor $(\frac{g/m^2/yr}{g/sec})$

Same as for soil (maximum value for a particular exposure area)

Duration of Deposition = 0.33 years

Unit Conversion Factors = 1.00E-03 kg/g x 1.00E+06 mg/kg

% Not removed = Efficiency of washing vegetables (50%)

Weight of Vegetable = 1 lb or 0.454 kg.

Surface Area = Area of vegetable exposed to deposition (0.05 m^2)

The compound concentration in the vegetables (C_{veg}) is again expressed as mg/kg. C_{veg} is a function of stack gas emission, Chi/Q, deposition duration, particulate removal efficiency by washing, unit conversion factors, and the weight of the vegetable per unit area. C_{veg} is similar to C_{soil} in

that the chi/q factor is a deposition factor instead of a dispersion factor.

The duration of deposition is dependent upon the time to harvest for the vegetables. This varies depending upon the vegetable, ranging from 21 days to four months. The more conservative four-month, or one-third-year, duration is assumed for use in this risk assessment. Washing removes dirt and contaminants from the vegetables. Fifty percent of the contaminants is assumed to be removed by washing. The surface area and weight of vegetables vary widely. Lettuce was used as a representative vegetable and, because of its large surface area, will provide a worst-case exposure scenario. The surface area is the area of edible portion exposed to deposition and is assumed to be one-half of the surface area. The estimated surface area for lettuce is 0.05 m^2 assuming a seven-inch diameter. Lettuce is assumed to weigh one pound.

The following example calculates the C_{veg} for an organic compound, Aldrin, from the submerged quench incinerator on an on-site receptor.

Assuming that:

ER = 3.64E-07 g/sec

Chi/q = 2.989 $\frac{g/m^2/yr}{g/sec}$

Duration of Deposition = 0.33 yr

% Not Removed = 0.50

Unit Correction Factors = 1.00E-03 kg/g x 1.00E+06 mg/kg

Weight of Vegetable = 0.454 kg

Surface Area = 0.05 m^2

Solving:

C_{veg} (aldrin) =

$$\frac{(3.64E\text{-}07 g/sec) \times (2.989 \frac{g/m^2/yr}{g/sec}) \times (0.33 yr) \times 0.50 \times (1E\text{-}03 kg/g) (1E+06 mg/kg)}{0.454 kg/0.05 m^2}$$

= 1.99E-05 mg/kg

For each compound subject to deposition, the maximum vegetable concentration at a particular exposure area was estimated by multiplying the compound emission rate (assumed as particulate) by the appropriate maximum, annual Chi/Q, and unit conversion factors, divided by the weight of the vegetable per unit surface area.

TABLE 4-1 - MAXIMUM AMBIENT AIR QUALITY IMPACTS FROM THE SQI ON ON-SITE RECEPTORS USING STAPLETON (1988)

COMPOUND	EMISSION RATE (G/SEC)	MAX 8-HOUR IMPACT		MAX ANNUAL IMPACT	
		CHI/Q CONC (MG/M3)	COMPOUND CONC (MG/M3)	CHI/Q CONC (MG/M3)	COMPOUND CONC (MG/M3)
methylene chloride	2.934E-04	1.341E-02	3.934E-06	5.762E-04	1.691E-07
chloroform	8.653E-06	1.341E-02	1.160E-07	5.762E-04	4.986E-09
carbon tetrachloride	3.043E-05	1.341E-02	4.081E-07	5.762E-04	1.753E-08
1,1,1 - TCE	2.333E-06	1.341E-02	3.129E-08	5.762E-04	1.344E-09
benzene	1.906E-05	1.341E-02	2.556E-07	5.762E-04	1.098E-08
toluene	5.114E-05	1.341E-02	6.858E-07	5.762E-04	2.947E-08
ethylbenzene	3.567E-04	1.341E-02	4.783E-06	5.762E-04	2.055E-07
xylenes	1.335E-04	1.341E-02	1.790E-06	5.762E-04	7.692E-08
dieldrin	3.147E-07	1.341E-02	4.220E-09	5.762E-04	1.813E-10
4,4' - DDT	3.147E-07	1.341E-02	4.220E-09	5.762E-04	1.813E-10
4,4' - DDE	3.147E-07	1.341E-02	4.220E-09	5.762E-04	1.813E-10
bis (2-Ethylhexyl) phthalate	1.512E-04	1.341E-02	2.028E-06	5.762E-04	8.712E-08
Di-n-butylphthalate	2.039E-04	1.341E-02	2.734E-06	5.762E-04	1.175E-07
aldrin	3.644E-07	1.341E-02	4.887E-09	5.762E-04	2.100E-10
tetrachlorodibenzofuran	6.378E-10	1.341E-02	8.553E-12	5.762E-04	3.675E-13
hexachlorodibenzofuran	6.287E-09	1.341E-02	8.431E-11	5.762E-04	3.623E-12
pentachlorodibenzofuran	9.756E-10	1.341E-02	1.308E-11	5.762E-04	5.621E-13
TCDD	1.369E-10	1.341E-02	1.836E-12	5.762E-04	7.888E-14
PeCDD	3.305E-10	1.341E-02	4.432E-12	5.762E-04	1.904E-13
HxCDD	4.721E-10	1.341E-02	6.331E-12	5.762E-04	2.720E-13
Particulate	4.070E-01	1.341E-02	5.458E-03	5.762E-04	2.345E-04
arsenic	8.637E-05	1.341E-02	1.158E-06	5.762E-04	4.977E-08
antimony	2.306E-04	1.341E-02	3.092E-06	5.762E-04	1.329E-07
barium	2.818E-04	1.341E-02	3.779E-06	5.762E-04	1.624E-07
beryllium	2.161E-06	1.341E-02	2.898E-08	5.762E-04	1.245E-09
cadmium	9.393E-05	1.341E-02	1.260E-06	5.762E-04	5.412E-08
calcium	1.751E-02	1.341E-02	2.348E-04	5.762E-04	1.009E-05
chromium	8.555E-06	1.341E-02	1.147E-07	5.762E-04	4.929E-09
copper	3.100E-03	1.341E-02	4.157E-05	5.762E-04	1.786E-06
iron	5.116E-04	1.341E-02	6.861E-06	5.762E-04	2.948E-07
lead	2.989E-04	1.341E-02	4.008E-06	5.762E-04	1.722E-07
magnesium	3.845E-04	1.341E-02	5.156E-06	5.762E-04	2.215E-07
nickel	6.902E-05	1.341E-02	9.256E-07	5.762E-04	3.977E-08
potassium	3.929E-03	1.341E-02	5.269E-05	5.762E-04	2.264E-06
silver	4.339E-06	1.341E-02	5.819E-08	5.762E-04	2.500E-09
sodium	6.488E-02	1.341E-02	8.700E-04	5.762E-04	3.738E-05
thallium	8.637E-05	1.341E-02	1.158E-06	5.762E-04	4.977E-08
mercury	5.468E-05	1.341E-02	7.333E-07	5.762E-04	3.151E-08

TABLE 4-2 - MAXIMUM AMBIENT AIR QUALITY IMPACTS FROM THE SQI ON FENCELINE BOUNDARIES USING STAPLETON (1988)

COMPOUND	EMISSION RATE (G/SEC)	MAX 8-HOUR IMPACT		MAX ANNUAL IMPACT	
		CHI/Q CONC (MG/M3)	COMPOUND CONC (MG/M3)	CHI/Q CONC (MG/M3)	COMPOUND CONC (MG/M3)
methylene chloride	2.934E-04	2.820E-03	8.274E-07	2.710E-04	7.951E-08
chloroform	8.653E-06	2.820E-03	2.440E-08	2.710E-04	2.345E-09
carbon tetrachloride	3.043E-05	2.820E-03	8.581E-08	2.710E-04	8.247E-09
1,1,1 - TCE	2.333E-06	2.820E-03	6.579E-09	2.710E-04	6.322E-10
benzene	1.906E-05	2.820E-03	5.375E-08	2.710E-04	5.165E-09
toluene	5.114E-05	2.820E-03	1.442E-07	2.710E-04	1.386E-08
ethylbenzene	3.567E-04	2.820E-03	1.006E-06	2.710E-04	9.667E-08
xylenes	1.335E-04	2.820E-03	3.765E-07	2.710E-04	3.618E-08
dieldrin	3.147E-07	2.820E-03	8.875E-10	2.710E-04	8.528E-11
4,4' - DDT	3.147E-07	2.820E-03	8.875E-10	2.710E-04	8.528E-11
4,4' - DDE	3.147E-07	2.820E-03	8.875E-10	2.710E-04	8.528E-11
bis (2-Ethylhexyl) phthalate	1.512E-04	2.820E-03	4.264E-07	2.710E-04	4.098E-08
Di-n-butylphthalate	2.039E-04	2.820E-03	5.750E-07	2.710E-04	5.526E-08
aldrin	3.644E-07	2.820E-03	1.028E-09	2.710E-04	9.875E-11
tetrachlorodibenzofuran	6.378E-10	2.820E-03	1.799E-12	2.710E-04	1.728E-13
hexachlorodibenzofuran	6.287E-09	2.820E-03	1.773E-11	2.710E-04	1.704E-12
pentachlorodibenzofuran	9.756E-10	2.820E-03	2.751E-12	2.710E-04	2.644E-13
TCDD	1.369E-10	2.820E-03	3.861E-13	2.710E-04	3.710E-14
PeCDD	3.305E-10	2.820E-03	9.320E-13	2.710E-04	8.957E-14
HxCDD	4.721E-10	2.820E-03	1.331E-12	2.710E-04	1.279E-13
Particulate	4.070E-01	2.820E-03	1.148E-03	2.710E-04	1.103E-04
arsenic	8.637E-05	2.820E-03	2.436E-07	2.710E-04	2.341E-08
antimony	2.306E-04	2.820E-03	6.503E-07	2.710E-04	6.249E-08
barium	2.818E-04	2.820E-03	7.947E-07	2.710E-04	7.637E-08
beryllium	2.161E-06	2.820E-03	6.094E-09	2.710E-04	5.856E-10
cadmium	9.393E-05	2.820E-03	2.649E-07	2.710E-04	2.546E-08
calcium	1.751E-02	2.820E-03	4.938E-05	2.710E-04	4.745E-06
chromium	8.555E-06	2.820E-03	2.413E-08	2.710E-04	2.318E-09
copper	3.100E-03	2.820E-03	8.742E-06	2.710E-04	8.401E-07
iron	5.116E-04	2.820E-03	1.443E-06	2.710E-04	1.386E-07
lead	2.989E-04	2.820E-03	8.429E-07	2.710E-04	8.100E-08
magnesium	3.845E-04	2.820E-03	1.084E-06	2.710E-04	1.042E-07
nickel	6.902E-05	2.820E-03	1.946E-07	2.710E-04	1.870E-08
potassium	3.929E-03	2.820E-03	1.108E-05	2.710E-04	1.065E-06
silver	4.339E-06	2.820E-03	1.224E-08	2.710E-04	1.176E-09
sodium	6.488E-02	2.820E-03	1.830E-04	2.710E-04	1.758E-05
thallium	8.637E-05	2.820E-03	2.436E-07	2.710E-04	2.341E-08
mercury	5.468E-05	2.820E-03	1.542E-07	2.710E-04	1.482E-08

TABLE 4-3 - MAXIMUM AMBIENT AIR QUALITY IMPACTS FROM SQI ON AN INDIVIDUAL RESIDENCE USING STAPLETON (1988)

COMPOUND	EMISSION RATE (G/SEC)	MAX 8-HOUR IMPACT		MAX ANNUAL IMPACT	
		CHI/Q CONC. (MG/M3)	COMPOUND CONC. (MG/M3)	CHI/Q CONC. (MG/M3)	COMPOUND CONC. (MG/M3)
methylene chloride	2.934E-04	1.962E-03	5.757E-07	2.106E-04	6.179E-08
chloroform	8.653E-06	1.962E-03	1.698E-08	2.106E-04	1.822E-09
carbon tetrachloride	3.043E-05	1.962E-03	5.970E-08	2.106E-04	6.409E-09
1,1,1 - TCE	2.333E-06	1.962E-03	4.577E-09	2.106E-04	4.913E-10
benzene	1.906E-05	1.962E-03	3.740E-08	2.106E-04	4.014E-09
toluene	5.114E-05	1.962E-03	1.003E-07	2.106E-04	1.077E-08
ethylbenzene	3.567E-04	1.962E-03	6.998E-07	2.106E-04	7.512E-08
xylenes	1.335E-04	1.962E-03	2.619E-07	2.106E-04	2.812E-08
dieldrin	3.147E-07	1.962E-03	6.174E-10	2.106E-04	6.628E-11
4,4' - DDT	3.147E-07	1.962E-03	6.174E-10	2.106E-04	6.628E-11
4,4' - DDE	3.147E-07	1.962E-03	6.174E-10	2.106E-04	6.628E-11
bis (2-Ethylhexyl) phthalate	1.512E-04	1.962E-03	2.967E-07	2.106E-04	3.184E-08
Di-n-butylphthalate	2.039E-04	1.962E-03	4.001E-07	2.106E-04	4.294E-08
aldrin	3.644E-07	1.962E-03	7.150E-10	2.106E-04	7.674E-11
tetrachlorodibenzofuran	6.378E-10	1.962E-03	1.251E-12	2.106E-04	1.343E-13
hexachlorodibenzofuran	6.287E-09	1.962E-03	1.234E-11	2.106E-04	1.324E-12
pentachlorodibenzofuran	9.756E-10	1.962E-03	1.914E-12	2.106E-04	2.055E-13
TCDD	1.369E-10	1.962E-03	2.686E-13	2.106E-04	2.883E-14
PeCDD	3.305E-10	1.962E-03	6.484E-13	2.106E-04	6.960E-14
HxCDD	4.721E-10	1.962E-03	9.263E-13	2.106E-04	9.942E-14
Particulate	4.070E-01	1.962E-03	7.985E-04	2.106E-04	8.571E-05
arsenic	8.637E-05	1.962E-03	1.695E-07	2.106E-04	1.819E-08
antimony	2.306E-04	1.962E-03	4.524E-07	2.106E-04	4.856E-08
barium	2.818E-04	1.962E-03	5.529E-07	2.106E-04	5.935E-08
beryllium	2.161E-06	1.962E-03	4.240E-09	2.106E-04	4.551E-10
cadmium	9.393E-05	1.962E-03	1.843E-07	2.106E-04	1.978E-08
calcium	1.751E-02	1.962E-03	3.435E-05	2.106E-04	3.688E-06
chromium	8.555E-06	1.962E-03	1.678E-08	2.106E-04	1.802E-09
copper	3.100E-03	1.962E-03	6.082E-06	2.106E-04	6.529E-07
iron	5.116E-04	1.962E-03	1.004E-06	2.106E-04	1.077E-07
lead	2.989E-04	1.962E-03	5.864E-07	2.106E-04	6.295E-08
magnesium	3.845E-04	1.962E-03	7.544E-07	2.106E-04	8.098E-08
nickel	6.902E-05	1.962E-03	1.354E-07	2.106E-04	1.454E-08
potassium	3.929E-03	1.962E-03	7.709E-06	2.106E-04	8.274E-07
silver	4.339E-06	1.962E-03	8.513E-09	2.106E-04	9.138E-10
sodium	6.488E-02	1.962E-03	1.273E-04	2.106E-04	1.366E-05
thallium	8.637E-05	1.962E-03	1.695E-07	2.106E-04	1.819E-08
mercury	5.468E-05	1.962E-03	1.073E-07	2.106E-04	1.152E-08

TABLE 4-4 - MAXIMUM AMBIENT AIR QUALITY IMPACTS FROM SQI ON IRONDALE RESIDENTIAL AREAS USING STAPLETON (1988)

COMPOUND	EMISSION RATE (G/SEC)	MAX 8-HOUR IMPACT		MAX ANNUAL IMPACT	
		CHI/Q CONC (MG/M3)	COMPOUND CONC (MG/M3)	CHI/Q CONC (MG/M3)	COMPOUND CONC (MG/M3)
methylene chloride	2.934E-04	1.406E-03	4.125E-07	4.053E-05	1.189E-08
chloroform	8.653E-06	1.406E-03	1.217E-08	4.053E-05	3.507E-10
carbon tetrachloride	3.043E-05	1.406E-03	4.278E-08	4.053E-05	1.233E-09
1,1,1 - TCE	2.333E-06	1.406E-03	3.280E-09	4.053E-05	9.456E-11
benzene	1.906E-05	1.406E-03	2.680E-08	4.053E-05	7.725E-10
toluene	5.114E-05	1.406E-03	7.190E-08	4.053E-05	2.073E-09
ethylbenzene	3.567E-04	1.406E-03	5.015E-07	4.053E-05	1.446E-08
xylenes	1.335E-04	1.406E-03	1.877E-07	4.053E-05	5.411E-09
dieldrin	3.147E-07	1.406E-03	4.425E-10	4.053E-05	1.275E-11
4,4' - DDT	3.147E-07	1.406E-03	4.425E-10	4.053E-05	1.275E-11
4,4' - DDE	3.147E-07	1.406E-03	4.425E-10	4.053E-05	1.275E-11
bis (2-Ethylhexyl) phthalate	1.512E-04	1.406E-03	2.126E-07	4.053E-05	6.128E-09
Di-n-butylphthalate	2.039E-04	1.406E-03	2.867E-07	4.053E-05	8.264E-09
aldrin	3.644E-07	1.406E-03	5.123E-10	4.053E-05	1.477E-11
tetrachlorodibenzofuran	6.378E-10	1.406E-03	8.967E-13	4.053E-05	2.585E-14
hexachlorodibenzofuran	6.287E-09	1.406E-03	8.840E-12	4.053E-05	2.548E-13
pentachlorodibenzofuran	9.756E-10	1.406E-03	1.372E-12	4.053E-05	3.954E-14
TCDD	1.369E-10	1.406E-03	1.925E-13	4.053E-05	5.549E-15
PeCDD	3.305E-10	1.406E-03	4.647E-13	4.053E-05	1.340E-14
HxCDD	4.721E-10	1.406E-03	6.638E-13	4.053E-05	1.913E-14
Particulate	4.070E-01	1.406E-03	5.722E-04	4.053E-05	1.650E-05
arsenic	8.637E-05	1.406E-03	1.214E-07	4.053E-05	3.501E-09
antimony	2.306E-04	1.406E-03	3.242E-07	4.053E-05	9.346E-09
barium	2.818E-04	1.406E-03	3.962E-07	4.053E-05	1.142E-08
beryllium	2.161E-06	1.406E-03	3.038E-09	4.053E-05	8.759E-11
cadmium	9.393E-05	1.406E-03	1.321E-07	4.053E-05	3.807E-09
calcium	1.751E-02	1.406E-03	2.462E-05	4.053E-05	7.097E-07
chromium	8.555E-06	1.406E-03	1.203E-08	4.053E-05	3.467E-10
copper	3.100E-03	1.406E-03	4.359E-06	4.053E-05	1.256E-07
iron	5.116E-04	1.406E-03	7.193E-07	4.053E-05	2.074E-08
lead	2.989E-04	1.406E-03	4.203E-07	4.053E-05	1.211E-08
magnesium	3.845E-04	1.406E-03	5.406E-07	4.053E-05	1.558E-08
nickel	6.902E-05	1.406E-03	9.704E-08	4.053E-05	2.797E-09
potassium	3.929E-03	1.406E-03	5.524E-06	4.053E-05	1.592E-07
silver	4.339E-06	1.406E-03	6.101E-09	4.053E-05	1.759E-10
sodium	6.488E-02	1.406E-03	9.122E-05	4.053E-05	2.630E-06
thallium	8.637E-05	1.406E-03	1.214E-07	4.053E-05	3.501E-09
mercury	5.468E-05	1.406E-03	7.688E-08	4.053E-05	2.216E-09

TABLE 4-5 - MAXIMUM AMBIENT AIR QUALITY IMPACTS FROM THE SQI ON NEARBY SCHOOLS USING STAPLETON (1988)

COMPOUND	EMISSION RATE (G/SEC)	MAX 8-HOUR IMPACT		MAX ANNUAL IMPACT	
		CHI/Q CONC (MG/M3)	COMPOUND CONC (MG/M3)	CHI/Q CONC (MG/M3)	COMPOUND CONC (MG/M3)
methylene chloride	2.934E-04	1.009E-03	2.960E-07	3.125E-05	9.169E-09
chloroform	8.653E-06	1.009E-03	8.731E-09	3.125E-05	2.704E-10
carbon tetrachloride	3.043E-05	1.009E-03	3.070E-08	3.125E-05	9.509E-10
1,1,1 - TCE	2.333E-06	1.009E-03	2.354E-09	3.125E-05	7.291E-11
benzene	1.906E-05	1.009E-03	1.923E-08	3.125E-05	5.956E-10
toluene	5.114E-05	1.009E-03	5.160E-08	3.125E-05	1.598E-09
ethylbenzene	3.567E-04	1.009E-03	3.599E-07	3.125E-05	1.115E-08
xylenes	1.335E-04	1.009E-03	1.347E-07	3.125E-05	4.172E-09
dieldrin	3.147E-07	1.009E-03	3.175E-10	3.125E-05	9.834E-12
4,4' - DDT	3.147E-07	1.009E-03	3.175E-10	3.125E-05	9.834E-12
4,4' - DDE	3.147E-07	1.009E-03	3.175E-10	3.125E-05	9.834E-12
bis (2-Ethylhexyl) phthalate	1.512E-04	1.009E-03	1.526E-07	3.125E-05	4.725E-09
Di-n-butylphthalate	2.039E-04	1.009E-03	2.057E-07	3.125E-05	6.372E-09
aldrin	3.644E-07	1.009E-03	3.677E-10	3.125E-05	1.139E-11
tetrachlorodibenzofuran	6.378E-10	1.009E-03	6.435E-13	3.125E-05	1.993E-14
hexachlorodibenzofuran	6.287E-09	1.009E-03	6.344E-12	3.125E-05	1.965E-13
pentachlorodibenzofuran	9.756E-10	1.009E-03	9.844E-13	3.125E-05	3.049E-14
TCDD	1.369E-10	1.009E-03	1.381E-13	3.125E-05	4.278E-15
PeCDD	3.305E-10	1.009E-03	3.335E-13	3.125E-05	1.033E-14
HxCDD	4.721E-10	1.009E-03	4.763E-13	3.125E-05	1.475E-14
Particulate	4.070E-01	1.009E-03	4.107E-04	3.125E-05	1.272E-05
arsenic	8.637E-05	1.009E-03	8.715E-08	3.125E-05	2.699E-09
antimony	2.306E-04	1.009E-03	2.327E-07	3.125E-05	7.206E-09
barium	2.818E-04	1.009E-03	2.843E-07	3.125E-05	8.806E-09
beryllium	2.161E-06	1.009E-03	2.180E-09	3.125E-05	6.753E-11
cadmium	9.393E-05	1.009E-03	9.478E-08	3.125E-05	2.935E-09
calcium	1.751E-02	1.009E-03	1.767E-05	3.125E-05	5.472E-07
chromium	8.555E-06	1.009E-03	8.632E-09	3.125E-05	2.673E-10
copper	3.100E-03	1.009E-03	3.128E-06	3.125E-05	9.687E-08
iron	5.116E-04	1.009E-03	5.162E-07	3.125E-05	1.599E-08
lead	2.989E-04	1.009E-03	3.016E-07	3.125E-05	9.341E-09
magnesium	3.845E-04	1.009E-03	3.880E-07	3.125E-05	1.202E-08
nickel	6.902E-05	1.009E-03	6.964E-08	3.125E-05	2.157E-09
potassium	3.929E-03	1.009E-03	3.964E-06	3.125E-05	1.228E-07
silver	4.339E-06	1.009E-03	4.378E-09	3.125E-05	1.356E-10
sodium	6.488E-02	1.009E-03	6.546E-05	3.125E-05	2.027E-06
thallium	8.637E-05	1.009E-03	8.715E-08	3.125E-05	2.699E-09
mercury	5.468E-05	1.009E-03	5.517E-08	3.125E-05	1.709E-09

TABLE 4-6 - MAXIMUM DEPOSITION IMPACTS FROM SQI ON ON-SITE RECEPTORS USING STAPLETON (1988)

COMPOUND	EMISSION RATE (G/SEC)	MAX ANNUAL IMPACT		RESULTANT SOIL CONC. (MG/KG)*	RESULTANT VEGETABLE CONC. (MG/KG)**
		CHI/Q DEPOSITION (GM/M2-YR)	COMPOUND DEPOSITION (GM/M2-YR)		
SEMI-VOLATILES					
bis (2-Ethylhexyl) phthalate	1.512E-04	2.989E+00	4.519E-04	1.027E-01	8.287E-03
Di-n-butylphthalate	2.039E-04	2.989E+00	6.095E-04	1.385E-01	1.118E-02
aldrin	3.644E-07	2.989E+00	1.089E-06	2.475E-04	1.997E-05
dieldrin	3.147E-07	2.989E+00	9.406E-07	2.138E-04	1.725E-05
4,4' - DDT	3.147E-07	2.989E+00	9.406E-07	2.138E-04	1.725E-05
4,4' - DDE	3.147E-07	2.989E+00	9.406E-07	2.138E-04	1.725E-05
TCDD	1.369E-10	2.989E+00	4.092E-10	9.300E-08	7.503E-09
PeCDD	3.305E-10	2.989E+00	9.879E-10	2.245E-07	1.811E-08
HxCDD	4.721E-10	2.989E+00	1.411E-09	3.207E-07	2.588E-08
pentachlorodibenzofuran	9.756E-10	2.989E+00	2.916E-09	6.627E-07	5.347E-08
tetrachlorodibenzofuran	6.378E-10	2.989E+00	1.906E-09	4.333E-07	3.496E-08
hexachlorodibenzofuran	6.287E-09	2.989E+00	1.879E-08	4.271E-06	3.446E-07
Particulate	4.070E-01	2.989E+00	1.217E+00	2.765E+02	2.231E+01
METALS					
arsenic	8.637E-05	2.989E+00	2.582E-04	5.867E-02	4.734E-03
antimony	2.306E-04	2.989E+00	6.893E-04	1.567E-01	1.264E-02
barium	2.818E-04	2.989E+00	8.423E-04	1.914E-01	1.545E-02
beryllium	2.161E-06	2.989E+00	6.459E-06	1.468E-03	1.184E-04
cadmium	9.393E-05	2.989E+00	2.808E-04	6.381E-02	5.148E-03
calcium	1.751E-02	2.989E+00	5.234E-02	1.189E+01	9.597E-01
chromium	8.555E-06	2.989E+00	2.557E-05	5.812E-03	4.689E-04
copper	3.100E-03	2.989E+00	9.266E-03	2.106E+00	1.699E-01
iron	5.116E-04	2.989E+00	1.529E-03	3.475E-01	2.804E-02
lead	2.989E-04	2.989E+00	8.934E-04	2.030E-01	1.638E-02
magnesium	3.845E-04	2.989E+00	1.149E-03	2.612E-01	2.107E-02
nickel	6.902E-05	2.989E+00	2.063E-04	4.689E-02	3.783E-03
potassium	3.929E-03	2.989E+00	1.174E-02	2.669E+00	2.153E-01
silver	4.339E-06	2.989E+00	1.297E-05	2.948E-03	2.378E-04
sodium	6.488E-02	2.989E+00	1.939E-01	4.407E+01	3.556E+00
thallium	8.637E-05	2.989E+00	2.582E-04	5.867E-02	4.734E-03
mercury	5.468E-05	2.989E+00	1.634E-04	3.715E-02	2.997E-03

* - Resultant soil concentration estimated by assuming a deposition duration of 1.5 years and a soil areal density of 6.6 kg/m2

** - Resultant vegetable concentration estimated by assuming a deposition duration of 0.33 years and a vegetable weighing 1 lb. with a surface area of 0.05 m2

TABLE 4-7 - MAXIMUM DEPOSITION IMPACTS FROM SQI ON FENCELINE BOUNDARY USING STAPLETON (1988)

COMPOUND	EMISSION RATE (G/SEC)	MAX ANNUAL IMPACT		RESULTANT SOIL CONC. (MG/KG)*	RESULTANT VEGETABLE CONC. (MG/KG)**
		CHI/Q DEPOSITION (GM/M2-YR)	COMPOUND DEPOSITION (GM/M2-YR)		
SEMI-VOLATILES					
bis (2-Ethylhexyl) phthalate	1.512E-04	9.421E-02	1.424E-05	3.237E-03	2.612E-04
Di-n-butylphthalate	2.039E-04	9.421E-02	1.921E-05	4.366E-03	3.522E-04
aldrin	3.644E-07	9.421E-02	3.433E-08	7.802E-06	6.295E-07
dieldrin	3.147E-07	9.421E-02	2.965E-08	6.738E-06	5.437E-07
4,4' - DDT	3.147E-07	9.421E-02	2.965E-08	6.738E-06	5.437E-07
4,4' - DDE	3.147E-07	9.421E-02	2.965E-08	6.738E-06	5.437E-07
TCDD	1.369E-10	9.421E-02	1.290E-11	2.931E-09	2.365E-10
PeCDD	3.305E-10	9.421E-02	3.114E-11	7.076E-09	5.709E-10
HxCDD	4.721E-10	9.421E-02	4.448E-11	1.011E-08	8.156E-10
pentachlorodibenzofuran	9.756E-10	9.421E-02	9.191E-11	2.089E-08	1.685E-09
tetrachlorodibenzofuran	6.378E-10	9.421E-02	6.009E-11	1.366E-08	1.102E-09
hexachlorodibenzofuran	6.287E-09	9.421E-02	5.923E-10	1.346E-07	1.086E-08
Particulate	4.070E-01	9.421E-02	3.834E-02	8.714E+00	7.031E-01
METALS					
arsenic	8.637E-05	9.421E-02	8.137E-06	1.849E-03	1.492E-04
antimony	2.306E-04	9.421E-02	2.172E-05	4.937E-03	3.984E-04
barium	2.818E-04	9.421E-02	2.655E-05	6.034E-03	4.868E-04
beryllium	2.161E-06	9.421E-02	2.036E-07	4.627E-05	3.733E-06
cadmium	9.393E-05	9.421E-02	8.849E-06	2.011E-03	1.623E-04
calcium	1.751E-02	9.421E-02	1.650E-03	3.749E-01	3.025E-02
chromium	8.555E-06	9.421E-02	8.060E-07	1.832E-04	1.478E-05
copper	3.100E-03	9.421E-02	2.921E-04	6.638E-02	5.355E-03
iron	5.116E-04	9.421E-02	4.820E-05	1.095E-02	8.838E-04
lead	2.989E-04	9.421E-02	2.816E-05	6.400E-03	5.164E-04
magnesium	3.845E-04	9.421E-02	3.622E-05	8.233E-03	6.642E-04
nickel	6.902E-05	9.421E-02	6.502E-06	1.478E-03	1.192E-04
potassium	3.929E-03	9.421E-02	3.702E-04	8.413E-02	6.787E-03
silver	4.339E-06	9.421E-02	4.088E-07	9.290E-05	7.496E-06
sodium	6.488E-02	9.421E-02	6.112E-03	1.389E+00	1.121E-01
thallium	8.637E-05	9.421E-02	8.137E-06	1.849E-03	1.492E-04
mercury	5.468E-05	9.421E-02	5.151E-06	1.171E-03	9.446E-05

* - Resultant soil concentration estimated by assuming a deposition duration of 1.5 years and a soil areal density of 6.6 kg/m2

** - Resultant vegetable concentration estimated by assuming a deposition duration of 0.33 years and a vegetable weighing 1 lb. with a surface area of 0.05 m2

TABLE 4-8 - MAXIMUM DEPOSITION IMPACTS FROM SQI ON AN INDIVIDUAL RESIDENCE USING STAPLETON (1988)

COMPOUND	EMISSION RATE (G/SEC)	MAX ANNUAL IMPACT		RESULTANT SOIL CONC. (MG/KG)*	RESULTANT VEGETABLE CONC. (MG/KG)**
		CHI/Q DEPOSITION (GM/M2-YR)	COMPOUND DEPOSITION (GM/M2-YR)		
SEMI-VOLATILES					
bis (2-Ethylhexyl) phthalate	1.512E-04	8.788E-02	1.329E-05	3.020E-03	2.437E-04
Di-n-butylphthalate	2.039E-04	8.788E-02	1.792E-05	4.072E-03	3.286E-04
aldrin	3.644E-07	8.788E-02	3.202E-08	7.278E-06	5.872E-07
dieldrin	3.147E-07	8.788E-02	2.766E-08	6.285E-06	5.071E-07
4,4' - DDT	3.147E-07	8.788E-02	2.766E-08	6.285E-06	5.071E-07
4,4' - DDE	3.147E-07	8.788E-02	2.766E-08	6.285E-06	5.071E-07
TCDD	1.369E-10	8.788E-02	1.203E-11	2.734E-09	2.206E-10
PeCDD	3.305E-10	8.788E-02	2.904E-11	6.601E-09	5.326E-10
HxCDD	4.721E-10	8.788E-02	4.149E-11	9.429E-09	7.608E-10
pentachlorodibenzofuran	9.756E-10	8.788E-02	8.574E-11	1.949E-08	1.572E-09
tetrachlorodibenzofuran	6.378E-10	8.788E-02	5.605E-11	1.274E-08	1.028E-09
hexachlorodibenzofuran	6.287E-09	8.788E-02	5.525E-10	1.256E-07	1.013E-08
Particulate	4.070E-01	8.788E-02	3.577E-02	8.129E+00	6.559E-01
METALS					
arsenic	8.637E-05	8.788E-02	7.590E-06	1.725E-03	1.392E-04
antimony	2.306E-04	8.788E-02	2.027E-05	4.606E-03	3.716E-04
barium	2.818E-04	8.788E-02	2.476E-05	5.628E-03	4.541E-04
beryllium	2.161E-06	8.788E-02	1.899E-07	4.316E-05	3.482E-06
cadmium	9.393E-05	8.788E-02	8.255E-06	1.876E-03	1.514E-04
calcium	1.751E-02	8.788E-02	1.539E-03	3.497E-01	2.822E-02
chromium	8.555E-06	8.788E-02	7.518E-07	1.709E-04	1.379E-05
copper	3.100E-03	8.788E-02	2.724E-04	6.192E-02	4.996E-03
iron	5.116E-04	8.788E-02	4.496E-05	1.022E-02	8.244E-04
lead	2.989E-04	8.788E-02	2.627E-05	5.970E-03	4.817E-04
magnesium	3.845E-04	8.788E-02	3.379E-05	7.680E-03	6.196E-04
nickel	6.902E-05	8.788E-02	6.065E-06	1.379E-03	1.112E-04
potassium	3.929E-03	8.788E-02	3.453E-04	7.847E-02	6.331E-03
silver	4.339E-06	8.788E-02	3.813E-07	8.666E-05	6.992E-06
sodium	6.488E-02	8.788E-02	5.702E-03	1.296E+00	1.046E-01
thallium	8.637E-05	8.788E-02	7.590E-06	1.725E-03	1.392E-04
mercury	5.468E-05	8.788E-02	4.805E-06	1.092E-03	8.811E-05

* - Resultant soil concentration estimated by assuming a deposition duration of 1.5 years and a soil areal density of 6.6 kg/m2

** - Resultant vegetable concentration estimated by assuming a deposition duration of 0.33 years and a vegetable weighing 1 lb. with a surface area of 0.05 m2

TABLE 4-9 - MAXIMUM DEPOSITION IMPACTS FROM SQI ON IRONDALE RESIDENTIAL AREAS USING STAPLETON (1988)

COMPOUND	EMISSION RATE (G/SEC)	MAX ANNUAL IMPACT		RESULTANT SOIL CONC. (MG/KG)*	RESULTANT VEGETABLE CONC. (MG/KG)**
		CHI/Q DEPOSITION (GM/M2-YR)	COMPOUND DEPOSITION (GM/M2-YR)		
SEMI-VOLATILES					
bis (2-Ethylhexyl) phthalate	1.512E-04	3.060E-02	4.627E-06	1.052E-03	8.484E-05
Di-n-butylphthalate	2.039E-04	3.060E-02	6.239E-06	1.418E-03	1.144E-04
aldrin	3.644E-07	3.060E-02	1.115E-08	2.534E-06	2.045E-07
dieldrin	3.147E-07	3.060E-02	9.630E-09	2.189E-06	1.766E-07
4,4' - DDT	3.147E-07	3.060E-02	9.630E-09	2.189E-06	1.766E-07
4,4' - DDE	3.147E-07	3.060E-02	9.630E-09	2.189E-06	1.766E-07
TCDD	1.369E-10	3.060E-02	4.189E-12	9.521E-10	7.682E-11
PeCDD	3.305E-10	3.060E-02	1.011E-11	2.298E-09	1.854E-10
HxCDD	4.721E-10	3.060E-02	1.445E-11	3.283E-09	2.649E-10
pentachlorodibenzofuran	9.756E-10	3.060E-02	2.985E-11	6.785E-09	5.474E-10
tetrachlorodibenzofuran	6.378E-10	3.060E-02	1.952E-11	4.436E-09	3.579E-10
hexachlorodibenzofuran	6.287E-09	3.060E-02	1.924E-10	4.372E-08	3.528E-09
Particulate	4.070E-01	3.060E-02	1.245E-02	2.830E+00	2.284E-01
METALS					
arsenic	8.637E-05	3.060E-02	2.643E-06	6.007E-04	4.846E-05
antimony	2.306E-04	3.060E-02	7.056E-06	1.604E-03	1.294E-04
barium	2.818E-04	3.060E-02	8.623E-06	1.960E-03	1.581E-04
beryllium	2.161E-06	3.060E-02	6.613E-08	1.503E-05	1.213E-06
cadmium	9.393E-05	3.060E-02	2.874E-06	6.532E-04	5.271E-05
calcium	1.751E-02	3.060E-02	5.358E-04	1.218E-01	9.825E-03
chromium	8.555E-06	3.060E-02	2.618E-07	5.950E-05	4.800E-06
copper	3.100E-03	3.060E-02	9.486E-05	2.156E-02	1.739E-03
iron	5.116E-04	3.060E-02	1.565E-05	3.558E-03	2.871E-04
lead	2.989E-04	3.060E-02	9.146E-06	2.079E-03	1.677E-04
magnesium	3.845E-04	3.060E-02	1.177E-05	2.674E-03	2.157E-04
nickel	6.902E-05	3.060E-02	2.112E-06	4.800E-04	3.873E-05
potassium	3.929E-03	3.060E-02	1.202E-04	2.732E-02	2.205E-03
silver	4.339E-06	3.060E-02	1.328E-07	3.018E-05	2.435E-06
sodium	6.488E-02	3.060E-02	1.985E-03	4.512E-01	3.640E-02
thallium	8.637E-05	3.060E-02	2.643E-06	6.007E-04	4.846E-05
mercury	5.468E-05	3.060E-02	1.673E-06	3.803E-04	3.068E-05

* - Resultant soil concentration estimated by assuming a deposition duration of 1.5 years and a soil areal density of 6.6 kg/m2

** - Resultant vegetable concentration estimated by assuming a deposition duration of 0.33 years and a vegetable weighing 1 lb. with a surface area of 0.05 m2

TABLE 4-10 - MAXIMUM DEPOSITION IMPACTS SQI ON NEARBY SCHOOLS USING STAPLETON (1988)

COMPOUND	EMISSION RATE (G/SEC)	MAX ANNUAL IMPACT		RESULTANT SOIL CONC. (MG/KG)*	RESULTANT VEGETABLE CONC. (MG/KG)**
		CHI/Q DEPOSITION (GM/M2-YR)	COMPOUND DEPOSITION (GM/M2-YR)		
SEMI-VOLATILES					
bis (2-Ethylhexyl) phthalate	1.512E-04	1.863E-02	2.817E-06	6.402E-04	5.165E-05
Di-n-butylphthalate	2.039E-04	1.863E-02	3.799E-06	8.633E-04	6.966E-05
aldrin	3.644E-07	1.863E-02	6.789E-09	1.543E-06	1.245E-07
dieldrin	3.147E-07	1.863E-02	5.863E-09	1.332E-06	1.075E-07
4,4' - DDT	3.147E-07	1.863E-02	5.863E-09	1.332E-06	1.075E-07
4,4' - DDE	3.147E-07	1.863E-02	5.863E-09	1.332E-06	1.075E-07
TCDD	1.369E-10	1.863E-02	2.550E-12	5.796E-10	4.677E-11
PeCDD	3.305E-10	1.863E-02	6.157E-12	1.399E-09	1.129E-10
HxCDD	4.721E-10	1.863E-02	8.795E-12	1.999E-09	1.613E-10
pentachlorodibenzofuran	9.756E-10	1.863E-02	1.818E-11	4.131E-09	3.333E-10
tetrachlorodibenzofuran	6.378E-10	1.863E-02	1.188E-11	2.701E-09	2.179E-10
hexachlorodibenzofuran	6.287E-09	1.863E-02	1.171E-10	2.662E-08	2.148E-09
Particulate	4.070E-01	1.863E-02	7.582E-03	1.723E+00	1.390E-01
METALS					
arsenic	8.637E-05	1.863E-02	1.609E-06	3.657E-04	2.951E-05
antimony	2.306E-04	1.863E-02	4.296E-06	9.764E-04	7.878E-05
barium	2.818E-04	1.863E-02	5.250E-06	1.193E-03	9.627E-05
beryllium	2.161E-06	1.863E-02	4.026E-08	9.150E-06	7.382E-07
cadmium	9.393E-05	1.863E-02	1.750E-06	3.977E-04	3.209E-05
calcium	1.751E-02	1.863E-02	3.262E-04	7.414E-02	5.982E-03
chromium	8.555E-06	1.863E-02	1.594E-07	3.622E-05	2.923E-06
copper	3.100E-03	1.863E-02	5.775E-05	1.313E-02	1.059E-03
iron	5.116E-04	1.863E-02	9.531E-06	2.166E-03	1.748E-04
lead	2.989E-04	1.863E-02	5.569E-06	1.266E-03	1.021E-04
magnesium	3.845E-04	1.863E-02	7.163E-06	1.628E-03	1.314E-04
nickel	6.902E-05	1.863E-02	1.286E-06	2.922E-04	2.358E-05
potassium	3.929E-03	1.863E-02	7.320E-05	1.664E-02	1.342E-03
silver	4.339E-06	1.863E-02	8.084E-08	1.837E-05	1.482E-06
sodium	6.488E-02	1.863E-02	1.209E-03	2.747E-01	2.216E-02
thallium	8.637E-05	1.863E-02	1.609E-06	3.657E-04	2.951E-05
mercury	5.468E-05	1.863E-02	1.019E-06	2.315E-04	1.868E-05

* - Resultant soil concentration estimated by assuming a deposition duration of 1.5 years and a soil areal density of 6.6 kg/m2

** - Resultant vegetable concentration estimated by assuming a deposition duration of 0.33 years and a vegetable weighing 1 lb. with a surface area of 0.05 m2

This section of the risk assessment discusses all assumptions used to estimate the amount of chemical taken into the exposed human body. Each of the following pathways was evaluated: inhalation of contaminants in air and ingestion of soil and vegetables contaminated by deposition. Intake factors are calculated in this section for air, soil, and vegetables. The daily chemical intake from any of these media is calculated by the product of the media-specific intake factor and the concentration of the chemical in that media.

5.1 AIR

Exposure to indicator chemicals results from the direct inhalation of volatile chemicals and particulate matter in the air. Human contaminant intake from air inhalation depends on the contaminant concentration, the rate of inhalation, and the exposure duration. Assumptions used to estimate exposure were taken from SEAM and the U.S. EPA Exposure Factors Handbook (EFH, U.S. EPA, 1989).

5.1.1 Public Inhalation Intake Factor - Adults

The assumptions used to determined the public inhalation intake factor are (1) a 20 m^3/day inhalation rate, (2) 70-kg body weight, and (3) a 70-year lifespan. The incineration of Basin F liquid was estimated to take 1.5 years, during which exposure would occur. It is also assumed that exposure occurs 24 hours per day every day for the entire one and one half-year period for a chronic exposure. The lifetime intake factor for inhalation is determined as follows:

$$\text{Lifetime Intake Factor}_{air} = \frac{(\text{Inhalation Rate})(\text{Exposure Frequency})}{(\text{Body Weight})(\text{Days of Life})}$$

$$\text{Lifetime Intake Factor}_{air} = \frac{(20\ m^3/\text{day})(1.5\ \text{years} \times 365\ \text{days/year})}{(70\ \text{kg})(70\ \text{years} \times 365\ \text{days/year})}$$

$$= 6.12E\text{-}03\ m^3/kg/day$$

Subchronic intake factors are used to estimate subchronic health impacts. Subchronic exposures are those that occur for less than 90 days. A daily intake factor is used to calculate the subchronic hazard index, and is computed as follows:

$$\text{Daily Intake Factor}_{air} = \frac{\text{Inhalation Rate}}{\text{Body Weight}}$$

$$= \frac{20\ m3/day}{70\ kg}$$

$$= 2.86E\text{-}01\ m^3/kg/day$$

5.1.2 Public Inhalation Intake Factor - Children

The assumptions used to determine the children's inhalation intake factor are listed below:

- The exposure occurs 24 hours each day.
- The length of time of exposure is 1.5 years, the total duration of the incinerator project.
- Children attend neighborhood schools. Therefore, the exposure concentrations at home and school are identical.
- The average inhalation rate is 21 m^3/day for ten-year old children and 16.8 m^3/day for six-year old children (EFH).
- The average body weight is 34.4 kg for ten-year olds and 21.5 kg for six-year olds (EFH).

- The indoor contaminant concentrations are equal to outdoor concentrations.

The lifetime inhalation intake factor for children is calculated below:

Lifetime Intake Factor (10-year olds)$_{air}$

$$= \frac{\text{(Inhalation Rate) (Exposure Frequency)}}{\text{(Body Weight)} \quad \text{(Days of Life)}}$$

$$= \frac{(21\ m^3/day)\ (1.5\ years \times 365\ days/year)}{(34.4kg)\ (70\ years \times 365\ days/year)}$$

$$= 1.31E\text{-}02\ m^3\ kg/day$$

Lifetime Intake Factor (6-year olds)$_{air}$

$$= \frac{(16.8\ m^3 day)\ (1.5\ years \times 365\ days/year)}{(21.5kg)\ (70\ years \times 365\ days/year)}$$

$$= 1.67E\text{-}02\ m^3/kg/day$$

The highest intake factor, 1.67E-02 m^3/kg/day for six-year olds, was used to calculate health risks. This is the most conservative approach and would not underestimate the actual health risk that may be experienced by children. An intake factor could not be calculated for 1 1/2 to 3-year olds because adequate data do not exist. A daily intake factor was calculated for infants using data available in the EFH, and it was lower than that of six-year olds.

The daily intake factor for subchronic exposures (less than 90 days) is calculated as follows for six-year olds.

Daily Intake Factor (six-year olds)$_{air}$

$$= \frac{\text{(Inhalation Rate)}}{\text{(Body Weight)}}$$

$$= \frac{16.8\ m^3/day}{21.5kg}$$

$$= 7.81E\text{-}01\ m^3/kg/day$$

5.1.3 On-Site Inhalation Intake Factor

The on-site inhalation intake factor requires the following assumptions:

- The RMA on-site population is exposed eight hours per day 5 days per week.
- The inhalation rate for an on-site worker is 7.1 m^3/hour (heavy activity) for 1 hour, 2.8 m^3 (moderate activity) for 4 hours, and 1.3 m^3/hr (light activity) for 3 hours for a total of 22.2 m^3 per 8-hour work day (Anderson et al., 1984, p. 131 Superfund Exposure Assessment Manual).
- The incineration of Basin F liquids requires 1.5 years.

The lifetime on-site inhalation intake factor is calculated as follows:

$$\text{On-Site Lifetime Intake Factor}_{air} = \frac{\text{(Inhalation Rate)(Exposure Frequency)}}{\text{(Body Weight)(Hours of Life)}}$$

$$= \frac{(22.2\ m^3/day)(1.5\ years \times 52\ weeks/years \times 5\ days/week \times 8\ hrs/day)}{(70Kg)(70\ years \times 52\ weeks/year \times 7\ days/week \times 24\ hrs/day)}$$

$$= 1.62E\text{-}03\ m^3/Kg/day$$

The subchronic inhalation intake factor for the on-site RMA receptor population is calculated as follows:

$$\text{Daily On-Site Intake Factor}_{air} = \frac{\text{Inhalation Rate}}{\text{Body Weight}}$$

$$= \frac{22.2\ m^3/day}{70\ Kg}$$

$$= 3.17E\text{-}01\ m^3/Kg/day$$

5.2 SOIL

Soil can be contaminated by particulate matter which is deposited directly on the surface from the air. Individuals ingest soil inadvertently when eating, smoking, or placing dirty hands in or around the mouth. Children tend to ingest more soil than adults. Because of increased soil ingestion in children, chemical intakes are calculated separately for children and adults. Soil ingestion rates of children (SEAM, 1988a) and body weight are presented in the table below.

Age	Ingested Days of Exposure	Soil mg/day	Assumed Body Weight, kg
0-9 mo	0	0	9
9-18 mo	2.74E+02	50	11.2
1½-3½ yrs	7.30E+02	200	14.1
3½-5 yrs	5.48E+02	50	18.4
5-18 yrs	4.75E+03	10	43.2
18-70 yrs	1.90E+04	10	70

The absorption of chemicals by the gastrointestinal tract is lower when the ingested chemical is bound to a solid matrix like soil, compared to absorption of the pure chemical or the chemical dissolved in water. This

difference in absorption is called a matrix effect. The matrix effect for chemicals in soil is reported to be 0.43 (Poiger and Schlatter, 1979).

Lifetime Oral Intake Factor$_{soil}$ =

$$\left[\frac{50}{11.2} \times \frac{2.74E+02}{2.56E+04} + \frac{200}{14.1} \times \frac{7.30E+02}{2.56E+04} + \frac{50}{18.4} \times \frac{5.48E+03}{2.56E+04}\right.$$

$$\left. + \frac{10}{43.2} \times \frac{4.75E+03}{2.56E+04} + \frac{10}{70} \times \frac{1.90E+04}{2.56E+04}\right] \text{ (0.43 absorption)}$$

= 1.18 E+00 (0.43)

= 5.09E-01 mg/kg/day

Converting to kg/kg/day = 5.09E-07 kg/kg/day

The lifetime oral soil intake factor is 5.09E-07 kg/kg/day, which is used for both chronic and carcinogenic toxicity evaluations.

The age range of 1 1/2 to 3 1/2 years old is utilized to calculate the soil intake factor for a short term exposure, as it represents the most conservative approach. The maximum daily intake factor for children between 1½ and 3½ is calculated below.

Subchronic Daily Intake Factor =

$$\frac{\text{(Daily Intake mg)}}{\text{(Body Weight kg)}} \text{ (absorption factor)}$$

$$= \frac{200 \text{ mg/day}}{14.1 \text{ kg}} \text{ (0.43)}$$

= 6.1 mg/kg/day

Converting to kg/kg/day = 6.10E-06 kg/kg/day

This factor was used to calculate the subchronic hazard index for soils.

5.3 VEGETABLES

Vegetables can be contaminated by chemicals being deposited directly on leaves or by uptake from the soil. Low concentrations of indicator chemicals are expected in soil from deposition because of the low deposition rates and the further dilution in soil from tilling. This will result in low concentrations in vegetables, in addition to the fact that the vegetables lack an active uptake mechanism for most of the indicator chemicals. Plant uptake from soil is assumed to result in insignificant increases in concentrations in plants compared to direct deposition on plants, and is not considered in this health risk assessment. Human intake of chemicals by ingestion of garden vegetables is calculated using the following assumptions concerning the intake of potentially contaminated vegetables:

- The daily intake of vegetables is 200 g/day (US EPA, 1989).
- The average lifetime body weight is 70 kg.
- The growing season is four months.
- Garden-grown leafy vegetables are available for consumption over a two-month period each year; eight weeks are required for growth to harvesting size.
- Preparation of the vegetables for eating include washing which removes only 50 percent of the deposited contaminants.
- When garden-grown vegetables are available, they make up 25 percent of the total vegetables consumed (US EPA, 1989).
- The exposure period is two growing seasons (years), which would be included in the 1.5 years required to incinerate the Basin F liquid.

Using the above assumptions, the lifetime daily intake factor for vegetable intake is calculated as follows:

Lifetime Daily Intake Factor (Vegetables) =

$$\frac{(I)(E)(PC)(PV)(\%\ \text{Not Removed})}{(BW)(YL)}$$

Where:

BW	= Body Weight, kg
I	= Daily intake of vegetables, kg/day
% Not Removed	= Percent contaminants remaining on vegetables after washing
E	= Exposure time of garden vegetables (years)
PC	= Percentage of year that garden vegetables are consumed
PV	= Percentage of garden vegetables consumed (Compared to total vegetable intake)
YL	= Years of a Lifetime

Lifetime Daily Intake Factor (Vegetables) =

$$\frac{(0.2\ \text{kg/day})(0.50)(1.5\ \text{years})(2/12)(0.25)}{(70\ \text{kg})\quad(70\ \text{years})}$$

= 1.28E-06 kg/kg/day

A second more conservative approach to Vegetable intake assumes that garden vegetables are canned and are available over the entire year.

The lifetime intake factor for vegetables using this assumption calculated as follows:

$$= \frac{(0.2 \text{ kg/day})(0.50)(1.5 \text{ years})(12/12)(0.25)}{(70 \text{ kg})\ (70 \text{ years})}$$

$$= 7.65\text{E-}06 \text{ kg/kg/day}$$

The intake factors calculated in this section and used in the risk calculations are summarized in the following table:

Exposure Route	Intake Factor	
	Lifetime	Subchronic
Inhalation Air (Adults)	6.12E-03	2.86E-01
Inhalation (Children)	1.67E-02	7.81E-01
Ingestion Soil	5.09E-07	6.10E-06
Ingestion Vegetables	1.28E-06	- - -
Ingestion Vegetables (Max)	7.65E-06	- - -
On-Site Inhalation Air	1.62E-03	3.17E-01

6.0 TOXICITY ASSESSMENT

Toxicity assessment consists of two steps. One is to summarize the known information on each chemical's toxicological properties, and the second is to identify critical toxicity values which is given below. Critical toxicity values are used to evaluate the carcinogenic and noncarcinogenic health risks. Critical toxicity values are EPA published values which reflect the degree of toxicity of chemicals. The EPA derivation of critical toxicity values uses evaluations by the Carcinogen Assessment Group, Health Effects Assessment documents, and its own verified reference doses. The critical toxicity values which describe the degree of toxicity for a chemical are:

- The acceptable intake for subchronic exposure (AIS)
- The acceptable intake for chronic exposure (AIC)
- The carcinogenic potency factor (for potential carcinogenic effects only).
- Reference doses

EPA has not derived critical toxicity values for all of the RMA indicator chemicals. The guidance in SPHEM, when there are no critical toxicity values, is to contact the Environmental Criteria and Assessment Office (ECAO) and request whether the toxicity information may be available. Because of time constraints in the preparation of this public health risk assessment and the length of time typically required to receive a response from ECAO, a conservative approach was taken. This approach required several assumptions to assign critical toxicity values which would not underestimate the actual noncarcinogenic health risks. The following assignments were made:

- The available AIS or AIC from one route of intake was used when another intake route did not have a value.

- When a chemical did not have an AIS or AIC, the values from a chemical with a similar chemical structure and toxicological properties was used.

Specific critical toxicity values are available for ingestion and inhalation routes of exposure. The critical toxicity values which are available for the RMA indicator chemicals are presented in the tables in Section 7.0.

7.0
RISK CHARACTERIZATION

This risk assessment step evaluates and summarizes the carcinogenic and noncarcinogenic health risks associated with each population and exposure scenario used in this risk assessment. This risk evaluation follows recommendations and procedures for implementation of Superfund risk assessment guidelines by EPA Region IX (1988b), guidelines from the "Superfund Public Health Evaluation Manual" (SPHEM), and the Superfund Exposure Assessment Manual (SEAM). These documents represent the U.S. Environmental Protection Agency's latest guidelines for performing health risk assessments. Region IX is the only EPA region to date to publish risk assessment guidelines. As such, this risk assessment addresses a range of acceptable estimated cancer risks from 1.00E-04 to 1.00E-07. This risk evaluation also agrees with Region IX guidance that a 1.00E-06 estimated cancer risk is not considered a de factor standard.

Cancer risk values derived using the approach recommended in SPHEM are upper bound estimates of excess cancer potentially arising from lifetime exposures to the chemical in question. A number of assumptions have been made in the derivation of these values. The actual incidence of cancer is likely to be lower than the estimates in this report which calculated the risk as recommended in SPHEM, and may even be zero. The noncarcinogenic health hazard (hazard index) may also be overestimated, since the assumption of additivity (of noncarcinogenic toxic effects) reflected in the hazard index equation, is most properly applied to compounds that induce the same systemic toxic effect by the same mechanism. Application of the equation to a mixture of compounds that do not induce the same systemic toxic effects may overestimate the potential for health risk.

The noncarcinogenic and carcinogenic risks are discussed separately below.

7.1 NONCARCINOGENIC RISKS

Noncarcinogenic risks are evaluated by comparing the daily intake of chemicals which exhibit noncarcinogenic effects with their respective reference doses. The evaluation of noncarcinogenic risk follows the risk assessment guidance given in SPHEM. Any single chemical with an exposure level greater than the reference level may cause concern for a potential health risk. To assess the overall potential for noncarcinogenic effects posed by multiple chemicals, a hazard index approach has been developed based on EPA's Guidelines for Health Risk Assessment of Chemical Mixtures (Chapter 7.1, EPA 1986). This approach assumes that multiple exposures to subthreshold levels of chemicals may result in an adverse effect. The hazard index is the sum of the daily intake divided by their respective reference levels. A significant deficiency in the hazard index approach is its failure to identify different toxicological end points for the potentially toxic chemicals that may be present. The hazard index can exceed one for multiple chemical exposures even if no single chemical exceeds its acceptable level.

The hazard index can be estimated for either subchronic (less than 90-day exposure) or chronic (over 90 days) exposures. The subchronic exposures were evaluated using the maximum 8-hour air dispersion modeling results for inhalation, the 1½ to 3½ year old child soil ingestion rate, and the daily intake of home grown vegetables each day of the year.

The hazard index is calculated by dividing the daily intake by the reference level which corresponds to the route of exposure. The formula for hazard index calculation is:

$$\text{Hazard Index} = \frac{\text{Daily Intake}}{\text{Acceptable Intake}}$$

Daily intakes based on exposures longer than 90 days are divided by the acceptable intake, chronic (AIC). Daily intakes based on exposures less than 90 days are divided by the acceptable intake, subchronic (AIS).

7.2 CARCINOGENIC RISKS

Carcinogenic risks are estimated as probabilities. The carcinogenic potency factor, which is an upper 95 percent confidence limit on the probability of response per unit intake of a chemical over a lifetime (i.e., only 5 percent chance that the probability of response could be greater than the estimated value on the basis of the experimental data used), converts estimated lifetime daily intakes directly to incremental risk. Because the exposure assessment in this risk assessment is conservative, as are assumptions used by the EPA to calculate the carcinogenic potency factor, the resultant predicted risk is an upper-bound estimate. Consequently, carcinogenic risk determined in this report, following the procedures in SPHEM, may overestimate the actual risk at a site, and the actual risk may be zero. This approach ensures that carcinogenic risk will not be underestimated. Carcinogenic risks are calculated by multiplying the chronic or lifetime daily intake quantity by the carcinogenic potency factor. In this risk assessment the maximum exposure concentrations at each exposure point were chosen to evaluate health risks.

Cancer risks are assumed to be additive. Thus cancer risks from inhalation of various chemicals is additive, as are the cancer risks from the exposure routes (inhalation and ingestion).

7.3 SUMMARY OF PUBLIC HEALTH RISKS

The carcinogenic risk, the subchronic hazard index, and the chronic hazard index have been calculated for each population and each route of exposure. These health risks were calculated using two different sets of

indicator chemicals. The first approach used both the chemicals actually detected in the stack gas of a pilot incineration test and several chemicals which could potentially be present in low concentrations in the stack gas, based on the composition of Basin F liquids. The second approach used only those chemicals actually detected in the stack gas.

A summary of the carcinogenic risk for each population and the two sets of chemicals is given in Table 7-1. The carcinogenic risks range from 3.26E-09 to 4.55E-07. A summary of the chronic exposure hazard index is given in Table 7-2. The chronic hazard index ranges from 2.47E-06 to 2.79E-04. A summary of the subchronic exposure hazard index is given in Table 7-3. The subchronic hazard index ranges from 2.59E-04 to 3.69E-03. The remaining tables, 7-4 through 7-47, show the detailed risk calculations for each receptor population.

TABLE 7-1

CARCINOGENIC RISK SUMMARY - ALL CHEMICALS

Locations	Inhalation	Soil	Vegetables	Vegetables Maximum	Total	Total Maximum
On-Site Receptors	5.11E-09	4.50E-07	--	--	4.55E-07	4.55E-07
Fenceline Receptors (Adult Inhalation)	9.09E-09	1.41E-08	2.86E-09	1.72E-08	2.61E-08	4.04E-08
Fenceline Receptors (Child Inhalation)	2.48E-08	1.41E-08	2.86E-09	1.72E-08	4.18E-08	5.61E-08
Nearest Residential Receptors (Adult Inhalation)	7.06E-09	1.32E-08	2.66E-09	1.60E-08	2.29E-08	3.63E-08
Nearest Residential Receptors (Child Inhalation)	1.93E-08	1.32E-08	2.66E-09	1.60E-08	3.51E-08	4.85E-08
Irondale Receptors (Adult Inhalation)	1.36E-09	4.61E-09	9.28E-10	5.59E-09	6.90E-09	1.16E-08
Irondale Receptors (Child Inhalation)	3.71E-09	4.61E-09	9.28E-10	5.59E-09	9.25E-09	1.40E-08
Hanson School (Child Inhalation)	2.88E-09	2.80E-09	5.65E-10	3.40E-09	6.25E-09	9.08E-09

TABLE 7-1
(Continued)

CARCINOGENIC RISK SUMMARY - DETECTED CHEMICALS

Locations	Inhalation	Soil	Vegetables	Vegetables Maximum	Total	Total Maximum
On-Site Receptors	9.77E-10	3.59E-07	--	--	3.60E-07	3.60E-07
Fenceline Receptors (Adult Inhalation)	1.74E-09	1.13E-08	2.28E-09	1.37E-08	1.53E-08	2.67E-08
Fenceline Receptors (Child Inhalation)	4.74E-09	1.13E-08	2.28E-09	1.37E-08	1.83E-08	2.97E-08
Nearest Residential Receptors (Adult Inhalation)	1.35E-09	1.06E-08	2.12E-09	1.28E-08	1.41E-08	2.48E-08
Nearest Residential Recepotrs (Child Inhalation)	3.68E-09	1.06E-08	2.12E-09	1.28E-08	1.64E-08	2.71E-08
Irondale Receptors (Adult Inhalation)	2.60E-10	3.67E-09	7.40E-10	4.46E-09	4.67E-09	9.13E-09
Irondale Receptors (Child Inhalation)	7.09E-10	3.67E-09	7.40E-10	4.46E-09	5.12E-09	9.58E-09
Hanson School (Child Inhalation)	5.65E-10	2.24E-09	4.50E-10	2.71E-09	3.26E-09	5.97E-09

TABLE 7-2

HAZARD INDEX SUMMARY - ALL CHEMICALS
CHRONIC EXPOSURE

Locations	Inhalation	Soil	Vegetables	Vegetables Maximum	Total	Total Maximum
On-Site Receptors	6.40E-06	2.73E-04	--	--	2.79E-04	2.79E-04
Fenceline Receptors (Adult Inhalation)	1.14E-05	8.71E-06	1.73E-06	1.04E-05	2.18E-05	3.05E-05
Fenceline Receptors (Child Inhalation)	3.10E-05	8.71E-06	1.73E-06	1.04E-05	4.14E-05	5.01E-05
Nearest Residential Receptors (Adult Inhalation)	8.84E-06	8.04E-06	1.62E-06	9.75E-06	1.85E-05	2.66E-05
Nearest Residential Receptors (Child Inhalation)	2.41E-05	8.04E-06	1.62E-06	9.75E-06	3.38E-05	4.19E-05
Irondale Receptors (Adult Inhalation)	1.70E-06	2.80E-06	5.63E-07	3.39E-06	5.06E-06	7.89E-06
Irondale Receptors (Child Inhalation)	4.64E-06	2.80E-06	5.63E-07	3.39E-06	8.00E-06	1.08E-05
Hanson School (Child Inhalation)	3.58E-06	1.70E-06	3.43E-07	2.07E-06	5.62E-06	7.35E-06

TABLE 7-2
(Continued)

HAZARD RISK SUMMARY - DETECTED CHEMICALS
CHRONIC EXPOSURE

Locations	Inhalation	Soil	Vegetables	Vegetables Maximum	Total	Total Maximum
On-Site Receptors	5.86E-06	7.40E-05	--	--	7.99E-05	7.99E-05
Fenceline Receptors (Adult Inhalation)	1.04E-05	2.47E-06	4.70E-07	2.83E-06	1.33E-05	1.57E-05
Fenceline Receptors (Child Inhalation)	2.84E-05	2.47E-06	4.70E-07	2.83E-06	3.13E-05	3.37E-05
Nearest Residential Receptors (Adult Inhalation)	8.10E-06	2.18E-06	4.38E-07	2.64E-06	1.07E-05	1.29E-05
Nearest Residential Receptors (Child Inhalation)	2.21E-05	2.18E-06	4.38E-07	2.64E-06	2.47E-05	2.69E-05
Irondale Receptors (Adult Inhalation)	1.56E-06	7.58E-07	1.53E-07	9.19E-07	2.47E-06	3.24E-06
Irondale Receptors (Child Inhalation)	4.25E-06	7.58E-07	1.53E-07	9.19E-07	5.16E-06	5.93E-06
Hanson School (Child Inhalation)	3.28E-06	4.61E-07	9.29E-08	5.59E-07	3.83E-06	4.30E-06

TABLE 7-3

HAZARD INDEX SUMMARY - ALL CHEMICALS
SUBCHRONIC EXPOSURE

Locations	Inhalation	Soil	Total
On-Site Receptors	2.93E-03	7.55E-04	3.69E-03
Fenceline Receptors (Adult Inhalation	5.56E-04	2.54E-05	5.81E-04
Fenceline Receptors (Child Inhalation	1.52E-03	2.54E-05	1.55E-03
Nearest Residential Receptors (Adult Inhalation)	3.87E-04	2.22E-05	4.09E-04
Nearest Residential Receptors (Child Inhalation)	1.06E-03	2.22E-05	1.08E-03
Irondale Receptors (Adult Inhalation)	2.77E-04	7.73E-06	2.85E-04
Irondale Receptors (Child Inhalation)	7.57E-04	7.73E-06	7.65E-04
Hanson School (Child Inhalation)	5.43E-04	4.71E-06	5.48E-04

TABLE 7-3
(Continued)

HAZARD INDEX SUMMARY - DETECTED CHEMICALS
SUBCHRONIC EXPOSURE

Locations	Inhalation	Soil	Total
On-Site Receptors	2.68E-03	5.16E-04	3.20E-03
Fenceline Receptors (Adult Inhalation)	5.09E-04	1.79E-05	5.27E-04
Fenceline Receptors (Child Inhalation)	1.39E-03	1.79E-05	1.41E-03
Nearest Residential Receptors (Adult Inhalation)	3.54E-04	1.52E-05	3.69E-04
Nearest Residential Receptors (Child Inhalation)	9.67E-04	1.52E-05	9.82E-04
Irondale Receptors (Adult Inhalation)	2.54E-04	5.28E-06	2.59E-04
Irondale Receptors (Child Inhalation)	6.93E-04	5.28E-06	6.98E-04
Hanson School (Child Inhalation)	4.98E-04	3.22E-06	5.01E-04

Table 7-4
Inhalation Risk Calculations - Adults
Including Chemicals Not Detected in the Stack
On-Site Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Arsenic	4.98E-008	1.62E-003	8.06E-011	5.00E+001	4.03E-009
Cadmium	5.41E-008	1.62E-003	8.77E-011	6.10E+000	5.35E-010
Chromium VI	4.93E-009	1.62E-003	7.98E-012	4.10E+001	3.27E-010
HxCDF	3.62E-012	1.62E-003	5.86E-015	1.56E+004	9.16E-011
PeCDF	5.62E-013	1.62E-003	9.10E-016	7.80E+004	7.10E-011
Dioxin	7.90E-014	1.62E-003	1.28E-016	1.56E+005	2.00E-011
TeCDF	3.68E-013	1.62E-003	5.96E-016	1.56E+004	9.29E-012
HxCDD	2.72E-013	1.62E-003	4.41E-016	1.56E+004	6.87E-012
Aldrin	2.10E-010	1.62E-003	3.40E-013	1.70E+001	5.78E-012
Dieldrin	1.81E-010	1.62E-003	2.94E-013	1.60E+001	4.70E-012
Methylene Chloride	1.69E-007	1.62E-003	2.74E-010	1.40E-002	3.84E-012
Carbon tetrachloride	1.75E-008	1.62E-003	2.84E-011	1.30E-001	3.69E-012
PeCDD	1.90E-013	1.62E-003	3.08E-016	7.80E+003	2.40E-012
Chloroform	4.99E-009	1.62E-003	8.08E-012	8.10E-002	6.54E-013
				Total	5.11E-009

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	4.16E-005	3.17E-001	1.32E-005	1.00E-002	1.32E-003
Barium	3.78E-006	3.17E-001	1.20E-006	1.40E-003	8.56E-004
Mercury (inorganic)	7.33E-007	3.17E-001	2.32E-007	5.10E-004	4.56E-004
Antimony	3.09E-006	3.17E-001	9.80E-007	4.00E-003	2.45E-004
Cadmium	1.26E-006	3.17E-001	3.99E-007	1.00E-002	3.99E-005
Nickel	9.26E-007	3.17E-001	2.93E-007	2.00E-002	1.47E-005
				Total	2.93E-003

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	1.79E-006	1.62E-003	2.89E-009	1.00E-003	2.89E-006
Barium	1.62E-007	1.62E-003	2.63E-010	1.40E-004	1.88E-006
Mercury (inorganic)	3.15E-008	1.62E-003	5.10E-011	5.10E-005	1.00E-006
Antimony	1.33E-007	1.62E-003	2.15E-010	4.00E-004	5.38E-007
Cadmium	5.41E-008	1.62E-003	8.77E-011	1.00E-003	8.77E-008
Nickel	3.98E-008	1.62E-003	6.44E-011	2.00E-002	3.22E-009
				Total	6.40E-006

Table 7-5
Oral Risk Calculations - Soil
Including Chemicals Not Detected in the Stack
On-Site Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	6.38E-002	5.09E-007	3.25E-008	6.10E+000	1.98E-007
Chromium VI	5.81E-003	5.09E-007	2.96E-009	4.10E+001	1.21E-007
Arsenic	5.87E-002	5.09E-007	2.99E-008	1.75E+000	5.23E-008
HxCDF	4.27E-006	5.09E-007	2.17E-012	1.56E+004	3.39E-008
PeCDF	6.63E-007	5.09E-007	3.37E-013	7.80E+004	2.63E-008
Dioxin	9.30E-008	5.09E-007	4.70E-014	1.56E+005	7.38E-009
TeCDF	4.33E-007	5.09E-007	2.21E-013	1.56E+004	3.44E-009
HxCDD	3.21E-007	5.09E-007	1.63E-013	1.56E+004	2.55E-009
Aldrin	2.47E-004	5.09E-007	1.26E-010	1.71E+001	2.15E-009
Dieldrin	2.14E-004	5.09E-007	1.09E-010	1.60E+001	1.74E-009
PeCDD	2.24E-007	5.09E-007	1.14E-013	7.80E+003	8.91E-010
				Total	4.50E-007

Hazard Index - Subchronic - Oral (Maximum Exposure -Child)

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Subchronic Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	2.11E+000	6.10E-006	1.28E-005	3.70E-002	3.47E-004
Antimony	1.57E-001	6.10E-006	9.56E-007	4.00E-003	2.39E-004
Mercury (inorganic)	3.71E-002	6.10E-006	2.27E-007	2.00E-003	1.13E-004
Cadmium	6.38E-002	6.10E-006	3.89E-007	1.00E-002	3.89E-005
Nickel	4.69E-002	6.10E-006	2.86E-007	2.00E-002	1.43E-005
Barium	1.91E-001	6.10E-006	1.17E-006	5.10E-001	2.29E-006
				Total	7.55E-004

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	1.57E-001	5.09E-007	7.98E-008	4.00E-004	1.99E-004
Cadmium	6.38E-002	5.09E-007	3.25E-008	1.00E-003	3.25E-005
Copper	2.11E+000	5.09E-007	1.07E-006	3.70E-002	2.90E-005
Mercury (inorganic)	3.71E-002	5.09E-007	1.89E-008	2.00E-003	9.45E-006
Barium	1.91E-001	5.09E-007	9.74E-008	5.10E-002	1.91E-006
Nickel	4.69E-002	5.09E-007	2.39E-008	2.00E-002	1.19E-006
				Total	2.73E-004

Table 7-6
Inhalation Risk Calculations - Adults
Including Chemicals Not Detected in the Stack
Fenceline Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Arsenic	2.34E-008	6.12E-003	1.43E-010	5.00E+001	7.16E-009
Cadmium	2.55E-008	6.12E-003	1.56E-010	6.10E+000	9.50E-010
Chromium VI	2.32E-009	6.12E-003	1.42E-011	4.10E+001	5.82E-010
HxCDF	1.70E-012	6.12E-003	1.00E-014	1.56E+004	1.63E-010
PeCDF	2.64E-013	6.12E-003	1.62E-015	7.80E+004	1.26E-010
Dioxin	3.70E-014	6.12E-003	2.29E-016	1.56E+005	3.53E-011
TeCDF	1.73E-013	6.12E-003	1.00E-015	1.56E+004	1.65E-011
HxCDD	1.28E-013	6.12E-003	7.83E-016	1.56E+004	1.22E-011
Aldrin	9.88E-011	6.12E-003	6.04E-013	1.70E+001	1.03E-011
Dieldrin	8.53E-011	6.12E-003	5.22E-013	1.60E+001	8.35E-012
Methylene Chloride	7.95E-008	6.12E-003	4.87E-010	1.40E-002	6.81E-012
Carbon tetrachloride	8.25E-009	6.12E-003	5.05E-011	1.30E-001	6.56E-012
PeCDD	9.00E-014	6.12E-003	5.51E-016	7.80E+003	4.30E-012
Chloroform	2.34E-009	6.12E-003	1.44E-011	8.10E-002	1.16E-012
				Total	9.09E-009

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	8.74E-006	2.86E-001	2.50E-006	1.00E-002	2.50E-004
Barium	7.95E-007	2.86E-001	2.27E-007	1.40E-003	1.62E-004
Mercury (inorganic)	1.54E-007	2.86E-001	4.41E-008	5.10E-004	8.65E-005
Antimony	6.50E-007	2.86E-001	1.86E-007	4.00E-003	4.65E-005
Cadmium	2.65E-007	2.86E-001	7.58E-008	1.00E-002	7.58E-006
Nickel	1.95E-007	2.86E-001	5.57E-008	2.00E-002	2.78E-006
				Total	5.56E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	8.40E-007	6.12E-003	5.14E-009	1.00E-003	5.14E-006
Barium	7.64E-008	6.12E-003	4.67E-010	1.40E-004	3.34E-006
Mercury (inorganic)	1.48E-008	6.12E-003	9.07E-011	5.10E-005	1.78E-006
Antimony	6.25E-008	6.12E-003	3.82E-010	4.00E-004	9.56E-007
Cadmium	2.55E-008	6.12E-003	1.56E-010	1.00E-003	1.56E-007
Nickel	1.87E-008	6.12E-003	1.14E-010	2.00E-002	5.72E-009
				Total	1.14E-005

Table 7-7
Inhalation Risk Calculations - 6-year-old children
Including Chemicals Not Detected in the Stack
Fenceline Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Arsenic	2.34E-008	1.67E-002	3.91E-010	5.00E+001	1.95E-008
Cadmium	2.55E-008	1.67E-002	4.25E-010	6.10E+000	2.59E-009
Chromium VI	2.32E-009	1.67E-002	3.87E-011	4.10E+001	1.59E-009
HxCDF	1.70E-012	1.67E-002	2.80E-014	1.56E+004	4.44E-010
PeCDF	2.64E-013	1.67E-002	4.41E-015	7.80E+004	3.44E-010
Dioxin	3.70E-014	1.67E-002	6.18E-016	1.56E+005	9.64E-011
TeCDF	1.73E-013	1.67E-002	2.89E-015	1.56E+004	4.50E-011
HxCDD	1.28E-013	1.67E-002	2.14E-015	1.56E+004	3.33E-011
Aldrin	9.88E-011	1.67E-002	1.65E-012	1.70E+001	2.80E-011
Dieldrin	8.53E-011	1.67E-002	1.42E-012	1.60E+001	2.28E-011
Methylene Chloride	7.95E-008	1.67E-002	1.33E-009	1.40E-002	1.86E-011
Carbon tetrachloride	8.25E-009	1.67E-002	1.38E-010	1.30E-001	1.79E-011
PeCDD	9.00E-014	1.67E-002	1.53E-015	7.80E+003	1.17E-011
Chloroform	2.34E-009	1.67E-002	3.92E-011	8.10E-002	3.17E-012
				Total	2.48E-008

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	8.74E-006	7.81E-001	6.83E-006	1.00E-002	6.83E-004
Barium	7.95E-007	7.81E-001	6.21E-007	1.40E-003	4.43E-004
Mercury (inorganic)	1.54E-007	7.81E-001	1.20E-007	5.10E-004	2.36E-004
Antimony	6.50E-007	7.81E-001	5.08E-007	4.00E-003	1.27E-004
Cadmium	2.65E-007	7.81E-001	2.07E-007	1.00E-002	2.07E-005
Nickel	1.95E-007	7.81E-001	1.52E-007	2.00E-002	7.60E-006
				Total	1.52E-003

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	8.40E-007	1.67E-002	1.40E-008	1.00E-003	1.40E-005
Barium	7.64E-008	1.67E-002	1.28E-009	1.40E-004	9.11E-006
Mercury (inorganic)	1.48E-008	1.67E-002	2.47E-010	5.10E-005	4.85E-006
Antimony	6.25E-008	1.67E-002	1.04E-009	4.00E-004	2.61E-006
Cadmium	2.55E-008	1.67E-002	4.25E-010	1.00E-003	4.25E-007
Nickel	1.87E-008	1.67E-002	3.12E-010	2.00E-002	1.56E-008
				Total	3.10E-005

Table 7-8
Oral Risk Calculations - Soil
Including Chemicals Not Detected in the Stack
Fenceline Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	2.01E-003	5.09E-007	1.02E-009	6.10E+000	6.24E-009
Chromium VI	1.83E-004	5.09E-007	9.32E-011	4.10E+001	3.82E-009
Arsenic	1.85E-003	5.09E-007	9.41E-010	1.75E+000	1.65E-009
HxCDF	1.35E-007	5.09E-007	6.90E-014	1.56E+004	1.07E-009
PeCDF	2.09E-008	5.09E-007	1.10E-014	7.80E+004	8.29E-010
Dioxin	2.93E-009	5.09E-007	1.49E-015	1.56E+005	2.33E-010
TeCDF	1.37E-008	5.09E-007	7.00E-015	1.56E+004	1.08E-010
Aldrin	7.80E-006	5.09E-007	3.97E-012	1.71E+001	6.79E-011
Dieldrin	6.74E-006	5.09E-007	3.43E-012	1.60E+001	5.49E-011
				Total	1.41E-008

Hazard Index - Subchronic - Oral (Maximum Exposure -Child)

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Subchronic Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	6.64E-002	6.10E-006	4.05E-007	3.70E-002	1.09E-005
Antimony	4.94E-003	6.10E-006	3.01E-008	4.00E-003	7.53E-006
Mercury (inorganic)	1.71E-003	6.10E-006	1.04E-008	2.00E-003	5.22E-006
Cadmium	2.01E-003	6.10E-006	1.23E-008	1.00E-002	1.23E-006
Nickel	1.48E-003	6.10E-006	9.02E-009	2.00E-002	4.51E-007
Barium	6.03E-003	6.10E-006	3.68E-008	5.10E-001	7.22E-008
				Total	2.54E-005

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	4.94E-003	5.09E-007	2.51E-009	4.00E-004	6.28E-006
Cadmium	2.01E-003	5.09E-007	1.02E-009	1.00E-003	1.02E-006
Copper	6.64E-002	5.09E-007	3.38E-008	3.70E-002	9.13E-007
Mercury (inorganic)	1.71E-003	5.09E-007	8.70E-010	2.00E-003	4.35E-007
Barium	6.03E-003	5.09E-007	3.07E-009	5.10E-002	6.02E-008
				Total	8.71E-006

Table 7-9
Oral Risk Calculations - Vegetables
Including Chemicals Not Detected in the Stack
Fenceline Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.62E-004	1.27E-006	2.06E-010	6.10E+000	1.26E-009
Chromium VI	1.48E-005	1.27E-006	1.88E-011	4.10E+001	7.70E-010
Arsenic	1.49E-004	1.27E-006	1.89E-010	1.75E+000	3.32E-010
HxCDF	1.09E-008	1.27E-006	1.40E-014	1.56E+004	2.15E-010
PeCDF	1.69E-009	1.27E-006	2.00E-015	7.80E+004	1.67E-010
Dioxin	2.36E-010	1.27E-006	3.00E-016	1.56E+005	4.69E-011
TeCDF	1.10E-009	1.27E-006	1.00E-015	1.56E+004	2.18E-011
HxCDD	8.16E-010	1.27E-006	1.00E-015	1.56E+004	1.62E-011
Aldrin	6.29E-007	1.27E-006	7.99E-013	1.71E+001	1.37E-011
Dieldrin	5.44E-007	1.27E-006	6.90E-013	1.60E+001	1.10E-011
PeCDD	5.71E-010	1.27E-006	7.25E-016	7.80E+003	5.65E-012
				Total	2.86E-009

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	3.98E-004	1.27E-006	5.06E-010	4.00E-004	1.26E-006
Cadmium	1.62E-004	1.27E-006	2.06E-010	1.00E-003	2.06E-007
Copper	5.36E-003	1.27E-006	6.80E-009	3.70E-002	1.84E-007
Mercury (inorganic)	9.45E-005	1.27E-006	1.20E-010	2.00E-003	6.00E-008
Barium	4.87E-004	1.27E-006	6.18E-010	5.10E-002	1.21E-008
Nickel	1.19E-004	1.27E-006	1.51E-010	2.00E-002	7.57E-009
				Total	1.73E-006

Table 7-10
Oral Risk Calculations - Vegetables
Maximum Exposure
Including Chemicals Not Detected in the Stack
Fenceline Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.62E-004	7.65E-006	1.24E-009	6.10E+000	7.57E-009
Chromium VI	1.48E-005	7.65E-006	1.13E-010	4.10E+001	4.64E-009
Arsenic	1.49E-004	7.65E-006	1.14E-009	1.75E+000	2.00E-009
HxCDF	1.09E-008	7.65E-006	8.30E-014	1.56E+004	1.30E-009
PeCDF	1.69E-009	7.65E-006	1.30E-014	7.80E+004	1.01E-009
Dioxin	2.36E-010	7.65E-006	1.80E-015	1.56E+005	2.82E-010
TeCDF	1.10E-009	7.65E-006	8.42E-015	1.56E+004	1.32E-010
HxCDD	8.16E-010	7.65E-006	6.24E-015	1.56E+004	9.73E-011
Aldrin	6.29E-007	7.65E-006	4.82E-012	1.71E+001	8.23E-011
Dieldrin	5.44E-007	7.65E-006	4.16E-012	1.60E+001	6.65E-011
PeCDD	5.71E-010	7.65E-006	4.37E-015	7.80E+003	3.41E-011
				Total	1.72E-008

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	3.98E-004	7.65E-006	3.05E-009	4.00E-004	7.62E-006
Cadmium	1.62E-004	7.65E-006	1.24E-009	1.00E-003	1.24E-006
Copper	5.36E-003	7.65E-006	4.10E-008	3.70E-002	1.11E-006
Mercury (inorganic)	9.45E-005	7.65E-006	7.23E-010	2.00E-003	3.61E-007
Barium	4.87E-004	7.65E-006	3.72E-009	5.10E-002	7.30E-008
Nickel	1.19E-004	7.65E-006	9.12E-010	2.00E-002	4.56E-008
				Total	1.04E-005

Table 7-11
Inhalation Risk Calculations - Adults
Including Chemicals Not Detected in the Stack
Nearest Residential Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Arsenic	1.82E-008	6.12E-003	1.11E-010	5.00E+001	5.57E-009
Cadmium	1.98E-008	6.12E-003	1.21E-010	6.10E+000	7.38E-010
Chromium VI	1.80E-009	6.12E-003	1.10E-011	4.10E+001	4.52E-010
HxCDF	1.32E-012	6.12E-003	8.00E-015	1.56E+004	1.26E-010
PeCDF	2.06E-013	6.12E-003	1.00E-015	7.80E+004	9.83E-011
Dioxin	2.90E-014	6.12E-003	1.77E-016	1.56E+005	2.77E-011
TeCDF	1.34E-013	6.12E-003	8.20E-016	1.56E+004	1.28E-011
HxCDD	9.90E-014	6.12E-003	6.06E-016	1.56E+004	9.45E-012
Aldrin	7.67E-011	6.12E-003	4.70E-013	1.70E+001	7.98E-012
Dieldrin	6.63E-011	6.12E-003	4.06E-013	1.60E+001	6.49E-012
Methylene Chloride	6.18E-008	6.12E-003	3.78E-010	1.40E-002	5.29E-012
Carbon tetrachloride	6.41E-009	6.12E-003	3.92E-011	1.30E-001	5.10E-012
PeCDD	7.00E-014	6.12E-003	4.28E-016	7.80E+003	3.34E-012
Chloroform	1.82E-009	6.12E-003	1.12E-011	8.10E-002	9.03E-013
				Total	7.06E-009

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	6.08E-006	2.86E-001	1.74E-006	1.00E-002	1.74E-004
Barium	5.53E-007	2.86E-001	1.58E-007	1.40E-003	1.13E-004
Mercury (inorganic)	1.07E-007	2.86E-001	3.07E-008	5.10E-004	6.02E-005
Antimony	4.52E-007	2.86E-001	1.29E-007	4.00E-003	3.23E-005
Cadmium	1.84E-007	2.86E-001	5.27E-008	1.00E-002	5.27E-006
Nickel	1.35E-007	2.86E-001	3.87E-008	2.00E-002	1.94E-006
				Total	3.87E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	6.53E-007	6.12E-003	4.00E-009	1.00E-003	4.00E-006
Barium	5.94E-008	6.12E-003	3.63E-010	1.40E-004	2.59E-006
Mercury (inorganic)	1.15E-008	6.12E-003	7.05E-011	5.10E-005	1.38E-006
Antimony	4.86E-008	6.12E-003	2.97E-010	4.00E-004	7.43E-007
Cadmium	1.98E-008	6.12E-003	1.21E-010	1.00E-003	1.21E-007
Nickel	1.45E-008	6.12E-003	8.90E-011	2.00E-002	4.45E-009
				Total	8.84E-006

Table 7-12
Inhalation Risk Calculations - 6-year-old children
Including Chemicals Not Detected in the Stack
Residential Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Arsenic	1.82E-008	1.67E-002	3.04E-010	5.00E+001	1.52E-008
Cadmium	1.98E-008	1.67E-002	3.30E-010	6.10E+000	2.01E-009
Chromium VI	1.80E-009	1.67E-002	3.01E-011	4.10E+001	1.23E-009
HxCDF	1.32E-012	1.67E-002	2.20E-014	1.56E+004	3.45E-010
PeCDF	2.06E-013	1.67E-002	3.44E-015	7.80E+004	2.68E-010
Dioxin	2.90E-014	1.67E-002	4.84E-016	1.56E+005	7.56E-011
TeCDF	1.34E-013	1.67E-002	2.24E-015	1.56E+004	3.49E-011
HxCDD	9.90E-014	1.67E-002	1.65E-015	1.56E+004	2.58E-011
Aldrin	7.67E-011	1.67E-002	1.28E-012	1.70E+001	2.18E-011
Dieldrin	6.63E-011	1.67E-002	1.11E-012	1.60E+001	1.77E-011
Methylene Chloride	6.18E-008	1.67E-002	1.03E-009	1.40E-002	1.44E-011
Carbon tetrachloride	6.41E-009	1.67E-002	1.07E-010	1.30E-001	1.39E-011
PeCDD	7.00E-014	1.67E-002	1.17E-015	7.80E+003	9.12E-012
Chloroform	1.82E-009	1.67E-002	3.04E-011	8.10E-002	2.46E-012
				Total	1.93E-008

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	6.08E-006	7.81E-001	4.75E-006	1.00E-002	4.75E-004
Barium	5.53E-007	7.81E-001	4.32E-007	1.40E-003	3.08E-004
Mercury (inorganic)	1.07E-007	7.81E-001	8.38E-008	5.10E-004	1.64E-004
Antimony	4.52E-007	7.81E-001	3.53E-007	4.00E-003	8.83E-005
Cadmium	1.84E-007	7.81E-001	1.44E-007	1.00E-002	1.44E-005
Nickel	1.35E-007	7.81E-001	1.06E-007	2.00E-002	5.29E-006
				Total	1.06E-003

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	6.53E-007	1.67E-002	1.09E-008	1.00E-003	1.09E-005
Barium	5.94E-008	1.67E-002	9.91E-010	1.40E-004	7.08E-006
Mercury (inorganic)	1.15E-008	1.67E-002	1.92E-010	5.10E-005	3.77E-006
Antimony	4.86E-008	1.67E-002	8.11E-010	4.00E-004	2.03E-006
Cadmium	1.98E-008	1.67E-002	3.30E-010	1.00E-003	3.30E-007
Nickel	1.45E-008	1.67E-002	2.43E-010	2.00E-002	1.21E-008
				Total	2.41E-005

Table 7-13
Oral Risk Calculations - Soil
Including Chemicals Not Detected in the Stack
Nearest Residential Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.88E-003	5.09E-007	9.55E-010	6.10E+000	5.82E-009
Chromium VI	1.71E-004	5.09E-007	8.70E-011	4.10E+001	3.57E-009
Arsenic	1.72E-003	5.09E-007	8.78E-010	1.75E+000	1.54E-009
HxCDF	1.26E-007	5.09E-007	6.40E-014	1.56E+004	9.97E-010
PeCDF	1.95E-008	5.09E-007	1.00E-014	7.80E+004	7.74E-010
Dioxin	2.73E-009	5.09E-007	1.39E-015	1.56E+005	2.17E-010
TeCDF	1.27E-008	5.09E-007	6.00E-015	1.56E+004	1.01E-010
HxCDD	9.43E-009	5.09E-007	5.00E-015	1.56E+004	7.49E-011
Aldrin	7.28E-006	5.09E-007	3.70E-012	1.71E+001	6.33E-011
Dieldrin	6.28E-006	5.09E-007	3.20E-012	1.60E+001	5.12E-011
PeCDD	6.60E-009	5.09E-007	3.00E-015	7.80E+003	2.62E-011
				Total	1.32E-008

Hazard Index - Subchronic - Oral (Maximum Exposure -Child)

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Subchronic Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	6.19E-002	6.10E-006	3.78E-007	3.70E-002	1.02E-005
Antimony	4.61E-003	6.10E-006	2.81E-008	4.00E-003	7.02E-006
Mercury (inorganic)	1.09E-003	6.10E-006	6.66E-009	2.00E-003	3.33E-006
Cadmium	1.88E-003	6.10E-006	1.14E-008	1.00E-002	1.14E-006
Nickel	1.38E-003	6.10E-006	8.41E-009	2.00E-002	4.21E-007
Barium	5.63E-003	6.10E-006	3.43E-008	5.10E-001	6.73E-008
				Total	2.22E-005

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	4.61E-003	5.09E-007	2.34E-009	4.00E-004	5.86E-006
Cadmium	1.88E-003	5.09E-007	9.55E-010	1.00E-003	9.55E-007
Copper	6.19E-002	5.09E-007	3.15E-008	3.70E-002	8.52E-007
Mercury (inorganic)	1.09E-003	5.09E-007	5.56E-010	2.00E-003	2.78E-007
Barium	5.63E-003	5.09E-007	2.86E-009	5.10E-002	5.62E-008
Nickel	1.38E-003	5.09E-007	7.02E-010	2.00E-002	3.51E-008
				Total	8.04E-006

Table 7-14
Oral Risk Calculations - Vegetables
Including Chemicals Not Detected in the Stack
Nearest Residential Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.51E-004	1.27E-006	1.92E-010	6.10E+000	1.17E-009
Chromium VI	1.38E-005	1.27E-006	1.75E-011	4.10E+001	7.18E-010
Arsenic	1.39E-004	1.27E-006	1.77E-010	1.75E+000	3.09E-010
HxCDF	1.01E-008	1.27E-006	1.30E-014	1.56E+004	2.01E-010
PeCDF	1.57E-009	1.27E-006	2.00E-015	7.80E+004	1.56E-010
Dioxin	2.21E-010	1.27E-006	2.81E-016	1.56E+005	4.37E-011
TeCDF	1.03E-009	1.27E-006	1.00E-015	1.56E+004	2.04E-011
HxCDD	7.61E-010	1.27E-006	1.00E-015	1.56E+004	1.51E-011
Aldrin	5.87E-007	1.27E-006	7.46E-013	1.71E+001	1.28E-011
Dieldrin	5.07E-007	1.27E-006	6.44E-013	1.60E+001	1.03E-011
PeCDD	5.33E-010	1.27E-006	1.00E-015	7.80E+003	5.28E-012
				Total	2.66E-009

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	3.72E-004	1.27E-006	4.72E-010	4.00E-004	1.18E-006
Cadmium	1.51E-004	1.27E-006	1.92E-010	1.00E-003	1.92E-007
Copper	5.00E-003	1.27E-006	6.34E-009	3.70E-002	1.71E-007
Mercury (inorganic)	8.81E-005	1.27E-006	1.12E-010	2.00E-003	5.59E-008
Barium	4.54E-004	1.27E-006	5.77E-010	5.10E-002	1.13E-008
Nickel	1.11E-004	1.27E-006	1.41E-010	2.00E-002	7.06E-009
				Total	1.62E-006

Table 7-15
Oral Risk Calculations - Vegetables
Maximum Exposure
Including Chemicals Not Detected in the Stack
Nearest Residential Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.51E-004	7.65E-006	1.16E-009	6.10E+000	7.07E-009
Chromium VI	1.38E-005	7.65E-006	1.05E-010	4.10E+001	4.33E-009
Arsenic	1.39E-004	7.65E-006	1.06E-009	1.75E+000	1.86E-009
HxCDF	1.01E-008	7.65E-006	7.70E-014	1.56E+004	1.21E-009
PeCDF	1.57E-009	7.65E-006	1.20E-014	7.80E+004	9.38E-010
Dioxin	2.21E-010	7.65E-006	1.69E-015	1.56E+005	2.63E-010
TeCDF	1.03E-009	7.65E-006	8.00E-015	1.56E+004	1.23E-010
HxCDD	7.61E-010	7.65E-006	6.00E-015	1.56E+004	9.08E-011
Aldrin	5.87E-007	7.65E-006	4.49E-012	1.71E+001	7.68E-011
Dieldrin	5.07E-007	7.65E-006	3.88E-012	1.60E+001	6.21E-011
PeCDD	5.33E-010	7.65E-006	4.00E-015	7.80E+003	3.18E-011
				Total	1.60E-008

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	3.72E-004	7.65E-006	2.84E-009	4.00E-004	7.11E-006
Cadmium	1.51E-004	7.65E-006	1.16E-009	1.00E-003	1.16E-006
Copper	5.00E-003	7.65E-006	3.82E-008	3.70E-002	1.03E-006
Mercury (inorganic)	8.81E-005	7.65E-006	6.74E-010	2.00E-003	3.37E-007
Barium	4.54E-004	7.65E-006	3.47E-009	5.10E-002	6.81E-008
Nickel	1.11E-004	7.65E-006	8.51E-010	2.00E-002	4.25E-008
				Total	9.75E-006

Table 7-16
Inhalation Risk Calculations - Adults
Including Chemicals Not Detected in the Stack
Irondale Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Arsenic	3.50E-009	6.12E-003	2.14E-011	5.00E+001	1.07E-009
Cadmium	3.81E-009	6.12E-003	2.33E-011	6.10E+000	1.42E-010
Chromium VI	3.47E-010	6.12E-003	2.12E-012	4.10E+001	8.70E-011
HxCDF	2.55E-013	6.12E-003	1.56E-015	1.56E+004	2.43E-011
PeCDF	4.00E-014	6.12E-003	2.45E-016	7.80E+004	1.91E-011
Dioxin	6.00E-015	6.12E-003	3.67E-017	1.56E+005	5.73E-012
TeCDF	2.60E-014	6.12E-003	1.59E-016	1.56E+004	2.48E-012
HxCDD	1.90E-014	6.12E-003	1.16E-016	1.56E+004	1.81E-012
Aldrin	1.48E-011	6.12E-003	9.10E-014	1.70E+001	1.54E-012
Dieldrin	1.27E-011	6.12E-003	7.80E-014	1.60E+001	1.25E-012
Methylene Chloride	1.19E-008	6.12E-003	7.28E-011	1.40E-002	1.02E-012
Carbon tetrachloride	1.23E-009	6.12E-003	7.55E-012	1.30E-001	9.81E-013
PeCDD	1.30E-014	6.12E-003	7.96E-017	7.80E+003	6.21E-013
Chloroform	3.51E-010	6.12E-003	2.15E-012	8.10E-002	1.74E-013
				Total	1.36E-009

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	4.36E-006	2.86E-001	1.25E-006	1.00E-002	1.25E-004
Barium	3.96E-007	2.86E-001	1.13E-007	1.40E-003	8.09E-005
Mercury (inorganic)	7.69E-008	2.86E-001	2.20E-008	5.10E-004	4.31E-005
Antimony	3.24E-007	2.86E-001	9.27E-008	4.00E-003	2.32E-005
Cadmium	1.32E-007	2.86E-001	3.78E-008	1.00E-002	3.78E-006
Nickel	9.70E-008	2.86E-001	2.78E-008	2.00E-002	1.39E-006
				Total	2.77E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	1.26E-007	6.12E-003	7.69E-010	1.00E-003	7.69E-007
Barium	1.14E-008	6.12E-003	6.99E-011	1.40E-004	4.99E-007
Mercury (inorganic)	2.22E-009	6.12E-003	1.36E-011	5.10E-005	2.66E-007
Antimony	9.35E-009	6.12E-003	5.72E-011	4.00E-004	1.43E-007
Cadmium	3.81E-009	6.12E-003	2.33E-011	1.00E-003	2.33E-008
Nickel	2.88E-009	6.12E-003	1.76E-011	2.00E-002	8.81E-010
				Total	1.70E-006

Table 7-17
Inhalation Risk Calculations - 6-year-old children
Including Chemicals Not Detected in the Stack
Irondale Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Arsenic	3.50E-009	1.67E-002	5.85E-011	5.00E+001	2.92E-009
Cadmium	3.81E-009	1.67E-002	6.36E-011	6.10E+000	3.88E-010
Chromium VI	3.47E-010	1.67E-002	5.79E-012	4.10E+001	2.37E-010
HxCDF	2.55E-013	1.67E-002	4.26E-015	1.56E+004	6.64E-011
PeCDF	4.00E-014	1.67E-002	6.68E-016	7.80E+004	5.21E-011
Dioxin	6.00E-015	1.67E-002	1.00E-016	1.56E+005	1.56E-011
TeCDF	2.60E-014	1.67E-002	4.34E-016	1.56E+004	6.77E-012
HxCDD	1.90E-014	1.67E-002	3.17E-016	1.56E+004	4.95E-012
Aldrin	1.48E-011	1.67E-002	2.47E-013	1.70E+001	4.20E-012
Dieldrin	1.27E-011	1.67E-002	2.13E-013	1.60E+001	3.41E-012
Methylene Chloride	1.19E-008	1.67E-002	1.99E-010	1.40E-002	2.78E-012
Carbon tetrachloride	1.23E-009	1.67E-002	2.06E-011	1.30E-001	2.68E-012
PeCDD	1.30E-014	1.67E-002	2.17E-016	7.80E+003	1.69E-012
Chloroform	3.51E-010	1.67E-002	5.86E-012	8.10E-002	4.74E-013
				Total	3.71E-009

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	4.36E-006	7.81E-001	3.40E-006	1.00E-002	3.40E-004
Barium	3.96E-007	7.81E-001	3.09E-007	1.40E-003	2.21E-004
Mercury (inorganic)	7.69E-008	7.81E-001	6.00E-008	5.10E-004	1.18E-004
Antimony	3.24E-007	7.81E-001	2.53E-007	4.00E-003	6.33E-005
Cadmium	1.32E-007	7.81E-001	1.03E-007	1.00E-002	1.03E-005
Nickel	9.70E-008	7.81E-001	7.58E-008	2.00E-002	3.79E-006
				Total	7.57E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	1.26E-007	1.67E-002	2.10E-009	1.00E-003	2.10E-006
Barium	1.14E-008	1.67E-002	1.91E-010	1.40E-004	1.36E-006
Mercury (inorganic)	2.22E-009	1.67E-002	3.70E-011	5.10E-005	7.26E-007
Antimony	9.35E-009	1.67E-002	1.56E-010	4.00E-004	3.90E-007
Cadmium	3.81E-009	1.67E-002	6.36E-011	1.00E-003	6.36E-008
Nickel	2.88E-009	1.67E-002	4.81E-011	2.00E-002	2.40E-009
				Total	4.64E-006

Table 7-18
Oral Risk Calculations - Soil
Including Chemicals Not Detected in the Stack
Irondale Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	6.53E-004	5.09E-007	3.32E-010	6.10E+000	2.03E-009
Chromium VI	5.95E-005	5.09E-007	3.03E-011	4.10E+001	1.24E-009
Arsenic	6.01E-004	5.09E-007	3.06E-010	1.75E+000	5.35E-010
HxCDF	4.37E-008	5.09E-007	2.20E-014	1.56E+004	3.47E-010
PeCDF	6.79E-009	5.09E-007	3.00E-015	7.80E+004	2.69E-010
Dioxin	9.52E-010	5.09E-007	4.85E-016	1.56E+005	7.56E-011
TeCDF	4.44E-009	5.09E-007	2.00E-015	1.56E+004	3.52E-011
HxCDD	3.28E-009	5.09E-007	2.00E-015	1.56E+004	2.61E-011
Aldrin	2.53E-006	5.09E-007	1.29E-012	1.71E+001	2.21E-011
Dieldrin	2.19E-006	5.09E-007	1.11E-012	1.60E+001	1.78E-011
PeCDD	2.30E-009	5.09E-007	1.00E-015	7.80E+003	9.12E-012
				Total	4.61E-009

Hazard Index - Subchronic - Oral (Maximum Exposure -Child)

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Subchronic Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	2.16E-002	6.10E-006	1.32E-007	3.70E-002	3.55E-006
Antimony	1.60E-003	6.10E-006	9.78E-009	4.00E-003	2.45E-006
Mercury (inorganic)	3.80E-004	6.10E-006	2.32E-009	2.00E-003	1.16E-006
Cadmium	6.53E-004	6.10E-006	3.98E-009	1.00E-002	3.98E-007
Nickel	4.80E-004	6.10E-006	2.93E-009	2.00E-002	1.46E-007
Barium	1.96E-003	6.10E-006	1.20E-008	5.10E-001	2.34E-008
				Total	7.73E-006

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	1.60E-003	5.09E-007	8.16E-010	4.00E-004	2.04E-006
Cadmium	6.53E-004	5.09E-007	3.32E-010	1.00E-003	3.32E-007
Copper	2.16E-002	5.09E-007	1.10E-008	3.70E-002	2.97E-007
Mercury (inorganic)	3.80E-004	5.09E-007	1.94E-010	2.00E-003	9.68E-008
Barium	1.96E-003	5.09E-007	9.98E-010	5.10E-002	1.96E-008
Nickel	4.80E-004	5.09E-007	2.44E-010	2.00E-002	1.22E-008
				Total	2.80E-006

Table 7-19
Oral Risk Calculations - Vegetables
Including Chemicals Not Detected in the Stack
Irondale Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	5.27E-005	1.27E-006	6.69E-011	6.10E+000	4.08E-010
Chromium VI	4.80E-006	1.27E-006	6.10E-012	4.10E+001	2.50E-010
Arsenic	4.85E-005	1.27E-006	6.15E-011	1.75E+000	1.08E-010
HxCDF	3.53E-009	1.27E-006	4.00E-015	1.56E+004	6.99E-011
PeCDF	5.47E-010	1.27E-006	6.95E-016	7.80E+004	5.42E-011
Dioxin	7.68E-011	1.27E-006	9.75E-017	1.56E+005	1.52E-011
TeCDF	3.58E-010	1.27E-006	4.55E-016	1.56E+004	7.09E-012
HxCDD	2.65E-010	1.27E-006	3.36E-016	1.56E+004	5.25E-012
Aldrin	2.04E-007	1.27E-006	2.60E-013	1.71E+001	4.44E-012
Dieldrin	1.77E-007	1.27E-006	2.24E-013	1.60E+001	3.59E-012
PeCDD	1.85E-010	1.27E-006	2.35E-016	7.80E+003	1.84E-012
				Total	9.28E-010

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	1.29E-004	1.27E-006	1.64E-010	4.00E-004	4.11E-007
Cadmium	5.27E-005	1.27E-006	6.69E-011	1.00E-003	6.69E-008
Copper	1.74E-003	1.27E-006	2.21E-009	3.70E-002	5.97E-008
Mercury (inorganic)	3.07E-005	1.27E-006	3.90E-011	2.00E-003	1.95E-008
Barium	1.58E-004	1.27E-006	2.01E-010	5.10E-002	3.94E-009
Nickel	3.87E-005	1.27E-006	4.92E-011	2.00E-002	2.46E-009
				Total	5.63E-007

Table 7-20
Oral Risk Calculations - Vegetables
Maximum Exposure
Including Chemicals Not Detected in the Stack
Irondale Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	5.27E-005	7.65E-006	4.03E-010	6.10E+000	2.46E-009
Chromium VI	4.80E-006	7.65E-006	3.67E-011	4.10E+001	1.51E-009
Arsenic	4.85E-005	7.65E-006	3.71E-010	1.75E+000	6.49E-010
HxCDF	3.53E-009	7.65E-006	2.70E-014	1.56E+004	4.21E-010
PeCDF	5.47E-010	7.65E-006	4.00E-015	7.80E+004	3.27E-010
Dioxin	7.68E-011	7.65E-006	5.88E-016	1.56E+005	9.17E-011
TeCDF	3.58E-010	7.65E-006	3.00E-015	1.56E+004	4.27E-011
HxCDD	2.65E-010	7.65E-006	2.00E-015	1.56E+004	3.16E-011
Aldrin	2.04E-007	7.65E-006	1.56E-012	1.71E+001	2.68E-011
Dieldrin	1.77E-007	7.65E-006	1.35E-012	1.60E+001	2.16E-011
PeCDD	1.85E-010	7.65E-006	1.00E-015	7.80E+003	1.11E-011
				Total	5.59E-009

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	1.29E-004	7.65E-006	9.90E-010	4.00E-004	2.47E-006
Cadmium	5.27E-005	7.65E-006	4.03E-010	1.00E-003	4.03E-007
Copper	1.74E-003	7.65E-006	1.33E-008	3.70E-002	3.60E-007
Mercury (inorganic)	3.07E-005	7.65E-006	2.35E-010	2.00E-003	1.17E-007
Barium	1.58E-004	7.65E-006	1.21E-009	5.10E-002	2.37E-008
Nickel	3.87E-005	7.65E-006	2.96E-010	2.00E-002	1.48E-008
				Total	3.39E-006

Table 7-21
Inhalation Risk Calculations - Adults
Including Chemicals Not Detected in the Stack
Hanson School

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Arsenic	2.70E-009	6.12E-003	1.65E-011	5.00E+001	8.26E-010
Cadmium	2.94E-009	6.12E-003	1.80E-011	6.10E+000	1.10E-010
Chromium VI	2.67E-010	6.12E-003	1.64E-012	4.10E+001	6.71E-011
HxCDF	1.96E-013	6.12E-003	1.00E-015	1.56E+004	1.87E-011
PeCDF	3.00E-014	6.12E-003	1.84E-016	7.80E+004	1.43E-011
Carbon tetrachloride	9.51E-009	6.12E-003	5.82E-011	1.30E-001	7.56E-012
Dioxin	4.00E-015	6.12E-003	2.45E-017	1.56E+005	3.82E-012
TeCDF	2.00E-014	6.12E-003	1.22E-016	1.56E+004	1.91E-012
HxCDD	1.50E-014	6.12E-003	9.18E-017	1.56E+004	1.43E-012
Aldrin	1.14E-011	6.12E-003	7.00E-014	1.70E+001	1.19E-012
Dieldrin	9.83E-012	6.12E-003	6.00E-014	1.60E+001	9.63E-013
Methylene Chloride	9.17E-009	6.12E-003	5.61E-011	1.40E-002	7.86E-013
PeCDD	1.00E-014	6.12E-003	6.12E-017	7.80E+003	4.77E-013
Chloroform	2.70E-010	6.12E-003	1.66E-012	8.10E-002	1.34E-013
				Total	1.05E-009

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	3.13E-006	2.86E-001	8.95E-007	1.00E-002	8.95E-005
Barium	2.84E-007	2.86E-001	8.13E-008	1.40E-003	5.81E-005
Mercury (inorganic)	5.52E-008	2.86E-001	1.58E-008	5.10E-004	3.09E-005
Antimony	2.33E-007	2.86E-001	6.66E-008	4.00E-003	1.66E-005
Cadmium	9.48E-008	2.86E-001	2.71E-008	1.00E-002	2.71E-006
Nickel	6.96E-008	2.86E-001	1.99E-008	2.00E-002	9.96E-007
				Total	1.99E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	9.69E-008	6.12E-003	5.93E-010	1.00E-003	5.93E-007
Barium	8.81E-009	6.12E-003	5.39E-011	1.40E-004	3.85E-007
Mercury (inorganic)	1.71E-009	6.12E-003	1.05E-011	5.10E-005	2.05E-007
Antimony	7.21E-009	6.12E-003	4.41E-011	4.00E-004	1.10E-007
Cadmium	2.94E-009	6.12E-003	1.80E-011	1.00E-003	1.80E-008
Nickel	2.16E-009	6.12E-003	1.32E-011	2.00E-002	6.60E-010
				Total	1.31E-006

Table 7-22
Inhalation Risk Calculations - 6-year-old children
Including Chemicals Not Detected in the Stack
Hanson School

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Arsenic	2.70E-009	1.67E-002	4.51E-011	5.00E+001	2.25E-009
Cadmium	2.94E-009	1.67E-002	4.90E-011	6.10E+000	2.99E-010
Chromium VI	2.67E-010	1.67E-002	4.46E-012	4.10E+001	1.83E-010
HxCDF	1.96E-013	1.67E-002	3.00E-015	1.56E+004	5.11E-011
PeCDF	3.00E-014	1.67E-002	5.01E-016	7.80E+004	3.91E-011
Carbon tetrachloride	9.51E-009	1.67E-002	1.59E-010	1.30E-001	2.06E-011
Dioxin	4.00E-015	1.67E-002	6.68E-017	1.56E+005	1.04E-011
TeCDF	2.00E-014	1.67E-002	3.34E-016	1.56E+004	5.21E-012
HxCDD	1.50E-014	1.67E-002	2.51E-016	1.56E+004	3.91E-012
Aldrin	1.14E-011	1.67E-002	1.90E-013	1.70E+001	3.23E-012
Dieldrin	9.83E-012	1.67E-002	1.64E-013	1.60E+001	2.63E-012
Methylene Chloride	9.17E-009	1.67E-002	1.53E-010	1.40E-002	2.14E-012
PeCDD	1.00E-014	1.67E-002	1.67E-016	7.80E+003	1.30E-012
Chloroform	2.70E-010	1.67E-002	4.52E-012	8.10E-002	3.66E-013
				Total	2.88E-009

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	3.13E-006	7.81E-001	2.44E-006	1.00E-002	2.44E-004
Barium	2.84E-007	7.81E-001	2.22E-007	1.40E-003	1.59E-004
Mercury (inorganic)	5.52E-008	7.81E-001	4.31E-008	5.10E-004	8.45E-005
Antimony	2.33E-007	7.81E-001	1.82E-007	4.00E-003	4.54E-005
Cadmium	9.48E-008	7.81E-001	7.40E-008	1.00E-002	7.40E-006
Nickel	6.96E-008	7.81E-001	5.44E-008	2.00E-002	2.72E-006
				Total	5.43E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	9.69E-008	1.67E-002	1.62E-009	1.00E-003	1.62E-006
Barium	8.81E-009	1.67E-002	1.47E-010	1.40E-004	1.05E-006
Mercury (inorganic)	1.71E-009	1.67E-002	2.85E-011	5.10E-005	5.60E-007
Antimony	7.21E-009	1.67E-002	1.20E-010	4.00E-004	3.01E-007
Cadmium	2.94E-009	1.67E-002	4.90E-011	1.00E-003	4.90E-008
Nickel	2.16E-009	1.67E-002	3.60E-011	2.00E-002	1.80E-009
				Total	3.58E-006

Table 7-23
Oral Risk Calculations - Soil
Including Chemicals Not Detected in the Stack
Hanson School

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	3.98E-004	5.09E-007	2.02E-010	6.10E+000	1.23E-009
Chromium VI	3.62E-005	5.09E-007	1.84E-011	4.10E+001	7.56E-010
Arsenic	3.66E-004	5.09E-007	1.86E-010	1.75E+000	3.26E-010
HxCDF	2.66E-008	5.09E-007	1.40E-014	1.56E+004	2.11E-010
PeCDF	4.13E-009	5.09E-007	2.00E-015	7.80E+004	1.64E-010
Dioxin	5.80E-010	5.09E-007	2.95E-016	1.56E+005	4.60E-011
TeCDF	2.70E-009	5.09E-007	1.37E-015	1.56E+004	2.14E-011
HxCDD	2.00E-009	5.09E-007	1.00E-015	1.56E+004	1.59E-011
Aldrin	1.54E-006	5.09E-007	7.85E-013	1.71E+001	1.34E-011
Dieldrin	1.33E-006	5.09E-007	6.78E-013	1.60E+001	1.08E-011
PeCDD	1.40E-009	5.09E-007	7.13E-016	7.80E+003	5.55E-012
				Total	2.80E-009

Hazard Index - Subchronic - Oral (Maximum Exposure -Child)

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Subchronic Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	1.31E-002	6.10E-006	8.01E-008	3.70E-002	2.16E-006
Antimony	9.76E-004	6.10E-006	5.96E-009	4.00E-003	1.49E-006
Mercury (inorganic)	2.32E-004	6.10E-006	1.41E-009	2.00E-003	7.06E-007
Cadmium	3.98E-004	6.10E-006	2.43E-009	1.00E-002	2.43E-007
Nickel	2.92E-004	6.10E-006	1.78E-009	2.00E-002	8.91E-008
Barium	1.19E-003	6.10E-006	7.28E-009	5.10E-001	1.43E-008
				Total	4.71E-006

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	9.76E-004	5.09E-007	4.97E-010	4.00E-004	1.24E-006
Cadmium	3.98E-004	5.09E-007	2.02E-010	1.00E-003	2.02E-007
Copper	1.31E-002	5.09E-007	6.68E-009	3.70E-002	1.81E-007
Mercury (inorganic)	2.32E-004	5.09E-007	1.18E-010	2.00E-003	5.89E-008
Barium	1.19E-003	5.09E-007	6.07E-010	5.10E-002	1.19E-008
Nickel	2.92E-004	5.09E-007	1.49E-010	2.00E-002	7.44E-009
				Total	1.70E-006

Table 7-24
Oral Risk Calculations - Vegetables
Including Chemicals Not Detected in the Stack
Hanson School

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	3.21E-005	1.27E-006	4.08E-011	6.10E+000	2.49E-010
Chromium VI	2.92E-006	1.27E-006	3.71E-012	4.10E+001	1.52E-010
Arsenic	2.95E-005	1.27E-006	3.75E-011	1.75E+000	6.56E-011
HxCDF	2.15E-009	1.27E-006	3.00E-015	1.56E+004	4.26E-011
PeCDF	3.33E-010	1.27E-006	4.23E-016	7.80E+004	3.30E-011
Dioxin	4.68E-011	1.27E-006	5.94E-017	1.56E+005	9.27E-012
TeCDF	2.18E-010	1.27E-006	2.77E-016	1.56E+004	4.32E-012
HxCDD	1.61E-010	1.27E-006	2.05E-016	1.56E+004	3.20E-012
Aldrin	1.25E-007	1.27E-006	1.58E-013	1.71E+001	2.70E-012
Dieldrin	1.08E-007	1.27E-006	1.37E-013	1.60E+001	2.18E-012
PeCDD	1.13E-010	1.27E-006	1.44E-016	7.80E+003	1.12E-012
				Total	5.65E-010

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	7.88E-005	1.27E-006	1.00E-010	4.00E-004	2.50E-007
Cadmium	3.21E-005	1.27E-006	4.08E-011	1.00E-003	4.08E-008
Copper	1.06E-003	1.27E-006	1.34E-009	3.70E-002	3.63E-008
Mercury (inorganic)	1.87E-005	1.27E-006	2.37E-011	2.00E-003	1.19E-008
Barium	9.63E-005	1.27E-006	1.22E-010	5.10E-002	2.40E-009
Nickel	2.36E-005	1.27E-006	2.99E-011	2.00E-002	1.50E-009
				Total	3.43E-007

Table 7-25
Oral Risk Calculations - Vegetables
Maximum Exposure
Including Chemicals Not Detected in the Stack
Hanson School

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	3.21E-005	7.65E-006	2.45E-010	6.10E+000	1.50E-009
Chromium VI	2.92E-006	7.65E-006	2.24E-011	4.10E+001	9.17E-010
Arsenic	2.95E-005	7.65E-006	2.26E-010	1.75E+000	3.95E-010
HxCDF	2.15E-009	7.65E-006	1.60E-014	1.56E+004	2.56E-010
PeCDF	3.33E-010	7.65E-006	3.00E-015	7.80E+004	1.99E-010
Dioxin	4.68E-011	7.65E-006	3.58E-016	1.56E+005	5.58E-011
TeCDF	2.18E-010	7.65E-006	2.00E-015	1.56E+004	2.60E-011
HxCDD	1.61E-010	7.65E-006	1.00E-015	1.56E+004	1.92E-011
Aldrin	1.25E-007	7.65E-006	9.52E-013	1.71E+001	1.63E-011
Dieldrin	1.08E-007	7.65E-006	8.22E-013	1.60E+001	1.32E-011
PeCDD	1.13E-010	7.65E-006	1.00E-015	7.80E+003	6.74E-012
				Total	3.40E-009

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Antimony	7.88E-005	7.65E-006	6.03E-010	4.00E-004	1.51E-006
Cadmium	3.21E-005	7.65E-006	2.45E-010	1.00E-003	2.45E-007
Copper	1.06E-003	7.65E-006	8.10E-009	3.70E-002	2.19E-007
Mercury (inorganic)	1.87E-005	7.65E-006	1.43E-010	2.00E-003	7.15E-008
Barium	9.63E-005	7.65E-006	7.36E-010	5.10E-002	1.44E-008
Nickel	2.36E-005	7.65E-006	1.80E-010	2.00E-002	9.02E-009
				Total	2.07E-006

Table 7-26
Inhalation Risk Calculations - Adults
Including Only Chemicals Detected in the Stack
On-Site Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	5.41E-008	1.62E-003	8.77E-011	6.10E+000	5.35E-010
Chromium VI	4.93E-009	1.62E-003	7.98E-012	4.10E+001	3.27E-010
HxCDF	3.62E-012	1.62E-003	6.00E-015	1.56E+004	9.16E-011
TeCDF	3.68E-013	1.62E-003	5.96E-016	1.56E+004	9.29E-012
Aldrin	2.10E-010	1.62E-003	3.40E-013	1.70E+001	5.78E-012
Methylene Chloride	1.69E-007	1.62E-003	2.74E-010	1.40E-002	3.84E-012
Carbon tetrachloride	1.75E-008	1.62E-003	2.84E-011	1.30E-001	3.69E-012
Chloroform	4.99E-009	1.62E-003	8.08E-012	8.10E-002	6.54E-013
				Total	9.77E-010

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	4.16E-005	3.17E-001	1.32E-005	1.00E-002	1.32E-003
Barium	3.78E-006	3.17E-001	1.20E-006	1.40E-003	8.56E-004
Mercury (inorganic)	7.33E-007	3.17E-001	2.32E-007	5.10E-004	4.56E-004
Cadmium	1.26E-006	3.17E-001	3.99E-007	1.00E-002	3.99E-005
Nickel	9.26E-007	3.17E-001	2.93E-007	2.00E-002	1.47E-005
				Total	2.68E-003

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	1.79E-006	1.62E-003	2.89E-009	1.00E-003	2.89E-006
Barium	1.62E-007	1.62E-003	2.63E-010	1.40E-004	1.88E-006
Mercury (inorganic)	3.15E-008	1.62E-003	5.10E-011	5.10E-005	1.00E-006
Cadmium	5.41E-008	1.62E-003	8.77E-011	1.00E-003	8.77E-008
Nickel	3.98E-008	1.62E-003	6.44E-011	2.00E-002	3.22E-009
				Total	5.86E-006

Table 7-27
Oral Risk Calculations - Soil
Including Only Chemicals Detected in the Stack
On-Site Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	6.38E-002	5.09E-007	3.25E-008	6.10E+000	1.98E-007
Chromium VI	5.81E-003	5.09E-007	2.96E-009	4.10E+001	1.21E-007
HxCDF	4.27E-006	5.09E-007	2.17E-012	1.56E+004	3.39E-008
TeCDF	4.33E-007	5.09E-007	2.21E-013	1.56E+004	3.44E-009
Aldrin	2.47E-004	5.09E-007	1.26E-010	1.71E+001	2.15E-009
				Total	3.59E-007

Hazard Index - Subchronic - Oral (Maximum Exposure -Child)

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Subchronic Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	2.11E+000	6.10E-006	1.28E-005	3.70E-002	3.47E-004
Mercury (inorganic)	3.71E-002	6.10E-006	2.27E-007	2.00E-003	1.13E-004
Cadmium	6.38E-002	6.10E-006	3.89E-007	1.00E-002	3.89E-005
Nickel	4.69E-002	6.10E-006	2.86E-007	2.00E-002	1.43E-005
Barium	1.91E-001	6.10E-006	1.17E-006	5.10E-001	2.29E-006
				Total	5.16E-004

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	6.38E-002	5.09E-007	3.25E-008	1.00E-003	3.25E-005
Copper	2.11E+000	5.09E-007	1.07E-006	3.70E-002	2.90E-005
Mercury (inorganic)	3.71E-002	5.09E-007	1.89E-008	2.00E-003	9.45E-006
Barium	1.91E-001	5.09E-007	9.74E-008	5.10E-002	1.91E-006
Nickel	4.69E-002	5.09E-007	2.39E-008	2.00E-002	1.19E-006
				Total	7.40E-005

Table 7-28
Inhalation Risk Calculations - Adults
Including Only Chemicals Detected in the Stack
Fenceline Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	2.55E-008	6.12E-003	1.56E-010	6.10E+000	9.50E-010
Chromium VI	2.32E-009	6.12E-003	1.42E-011	4.10E+001	5.82E-010
HxCDF	1.70E-012	6.12E-003	1.00E-014	1.56E+004	1.63E-010
TeCDF	1.73E-013	6.12E-003	1.00E-015	1.56E+004	1.65E-011
Aldrin	9.88E-011	6.12E-003	6.04E-013	1.70E+001	1.03E-011
Methylene Chloride	7.95E-008	6.12E-003	4.87E-010	1.40E-002	6.81E-012
Carbon tetrachloride	8.25E-009	6.12E-003	5.05E-011	1.30E-001	6.56E-012
Chloroform	2.34E-009	6.12E-003	1.44E-011	8.10E-002	1.16E-012
				Total	1.74E-009

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	8.74E-006	2.86E-001	2.50E-006	1.00E-002	2.50E-004
Barium	7.95E-007	2.86E-001	2.27E-007	1.40E-003	1.62E-004
Mercury (inorganic)	1.54E-007	2.86E-001	4.41E-008	5.10E-004	8.65E-005
Cadmium	2.65E-007	2.86E-001	7.58E-008	1.00E-002	7.58E-006
Nickel	1.95E-007	2.86E-001	5.57E-008	2.00E-002	2.78E-006
				Total	5.09E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	8.40E-007	6.12E-003	5.14E-009	1.00E-003	5.14E-006
Barium	7.64E-008	6.12E-003	4.67E-010	1.40E-004	3.34E-006
Mercury (inorganic)	1.48E-008	6.12E-003	9.07E-011	5.10E-005	1.78E-006
Cadmium	2.55E-008	6.12E-003	1.56E-010	1.00E-003	1.56E-007
Nickel	1.87E-008	6.12E-003	1.14E-010	2.00E-002	5.72E-009
				Total	1.04E-005

Table 7-29
Inhalation Risk Calculations - 6-year-old children
Including Only Chemicals Detected in the Stack
Fenceline Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	2.55E-008	1.67E-002	4.25E-010	6.10E+000	2.59E-009
Chromium VI	2.32E-009	1.67E-002	3.87E-011	4.10E+001	1.59E-009
HxCDF	1.70E-012	1.67E-002	2.80E-014	1.56E+004	4.44E-010
TeCDF	1.73E-013	1.67E-002	2.89E-015	1.56E+004	4.50E-011
Aldrin	9.88E-011	1.67E-002	1.65E-012	1.70E+001	2.80E-011
Methylene Chloride	7.95E-008	1.67E-002	1.33E-009	1.40E-002	1.86E-011
Carbon tetrachloride	8.25E-009	1.67E-002	1.38E-010	1.30E-001	1.79E-011
Chloroform	2.34E-009	1.67E-002	3.92E-011	8.10E-002	3.17E-012
				Total	4.74E-009

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	8.74E-006	7.81E-001	6.83E-006	1.00E-002	6.83E-004
Barium	7.95E-007	7.81E-001	6.21E-007	1.40E-003	4.43E-004
Mercury (inorganic)	1.54E-007	7.81E-001	1.20E-007	5.10E-004	2.36E-004
Cadmium	2.65E-007	7.81E-001	2.07E-007	1.00E-002	2.07E-005
Nickel	1.95E-007	7.81E-001	1.52E-007	2.00E-002	7.60E-006
				Total	1.39E-003

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	8.40E-007	1.67E-002	1.40E-008	1.00E-003	1.40E-005
Barium	7.64E-008	1.67E-002	1.28E-009	1.40E-004	9.11E-006
Mercury (inorganic)	1.48E-008	1.67E-002	2.47E-010	5.10E-005	4.85E-006
Cadmium	2.55E-008	1.67E-002	4.25E-010	1.00E-003	4.25E-007
Nickel	1.87E-008	1.67E-002	3.12E-010	2.00E-002	1.56E-008
				Total	2.84E-005

Table 7-30
Oral Risk Calculations - Soil
Including Only Chemicals Detected in the Stack
Fenceline Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor mg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	2.01E-003	5.09E-007	1.02E-009	6.10E+000	6.24E-009
Chromium VI	1.83E-004	5.09E-007	9.32E-011	4.10E+001	3.82E-009
HxCDF	1.35E-007	5.09E-007	6.90E-014	1.56E+004	1.07E-009
TeCDF	1.37E-008	5.09E-007	6.97E-015	1.56E+004	1.08E-010
Aldrin	7.80E-006	5.09E-007	3.97E-012	1.71E+001	6.79E-011
				Total	1.13E-008

Hazard Index - Subchronic - Oral (Maximum Exposure -Child)

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Subchronic Oral Intake Factor mg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	6.64E-002	6.10E-006	4.05E-007	3.70E-002	1.09E-005
Mercury (inorganic)	1.71E-003	6.10E-006	1.04E-008	2.00E-003	5.22E-006
Cadmium	2.01E-003	6.10E-006	1.23E-008	1.00E-002	1.23E-006
Nickel	1.48E-003	6.10E-006	9.02E-009	2.00E-002	4.51E-007
Barium	6.03E-003	6.10E-006	3.68E-008	5.10E-001	7.22E-008
				Total	1.79E-005

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor mg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	2.01E-003	5.09E-007	1.02E-009	1.00E-003	1.02E-006
Copper	6.64E-002	5.09E-007	3.38E-008	3.70E-002	9.13E-007
Mercury (inorganic)	1.71E-003	5.09E-007	8.70E-010	2.00E-003	4.35E-007
Barium	6.03E-003	5.09E-007	3.07E-009	5.10E-002	6.02E-008
Nickel	1.48E-003	5.09E-007	7.52E-010	2.00E-002	3.76E-008
				Total	2.47E-006

Table 7-31
Oral Risk Calculations - Vegetables
Including Only Chemicals Detected in the Stack
Fenceline Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.62E-004	1.27E-006	2.06E-010	6.10E+000	1.26E-009
Chromium VI	1.48E-005	1.27E-006	1.88E-011	4.10E+001	7.70E-010
HxCDF	1.09E-008	1.27E-006	1.40E-014	1.56E+004	2.15E-010
TeCDF	1.10E-009	1.27E-006	1.40E-015	1.56E+004	2.18E-011
Aldrin	6.29E-007	1.27E-006	7.99E-013	1.71E+001	1.37E-011
				Total	2.28E-009

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	1.62E-004	1.27E-006	2.06E-010	1.00E-003	2.06E-007
Copper	5.36E-003	1.27E-006	6.80E-009	3.70E-002	1.84E-007
Mercury (inorganic)	9.45E-005	1.27E-006	1.20E-010	2.00E-003	6.00E-008
Barium	4.87E-004	1.27E-006	6.18E-010	5.10E-002	1.21E-008
Nickel	1.19E-004	1.27E-006	1.51E-010	2.00E-002	7.57E-009
				Total	4.70E-007

Table 7-32
Oral Risk Calculations - Vegetables
Maximum Exposure
Including Only Chemicals Detected in the Stack
Fenceline Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.62E-004	7.65E-006	1.24E-009	6.10E+000	7.57E-009
Chromium VI	1.48E-005	7.65E-006	1.13E-010	4.10E+001	4.64E-009
HxCDF	1.09E-008	7.65E-006	8.30E-014	1.56E+004	1.30E-009
TeCDF	1.10E-009	7.65E-006	8.00E-015	1.56E+004	1.32E-010
Aldrin	6.29E-007	7.65E-006	4.82E-012	1.71E+001	8.23E-011
				Total	1.37E-008

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	1.62E-004	7.65E-006	1.24E-009	1.00E-003	1.24E-006
Copper	5.36E-003	7.65E-006	4.10E-008	3.70E-002	1.11E-006
Mercury (inorganic)	9.45E-005	7.65E-006	7.23E-010	2.00E-003	3.61E-007
Barium	4.87E-004	7.65E-006	3.72E-009	5.10E-002	7.30E-008
Nickel	1.19E-004	7.65E-006	9.12E-010	2.00E-002	4.56E-008
				Total	2.83E-006

Table 7-33
Inhalation Risk Calculations - Adults
Including Only Chemicals Detected in the Stack
Nearest Residential Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.98E-008	6.12E-003	1.21E-010	6.10E+000	7.38E-010
Chromium VI	1.80E-009	6.12E-003	1.10E-011	4.10E+001	4.52E-010
HxCDF	1.32E-012	6.12E-003	8.00E-015	1.56E+004	1.26E-010
TeCDF	1.34E-013	6.12E-003	1.00E-015	1.56E+004	1.28E-011
Aldrin	7.67E-011	6.12E-003	4.70E-013	1.70E+001	7.98E-012
Methylene Chloride	6.18E-008	6.12E-003	3.78E-010	1.40E-002	5.29E-012
Carbon tetrachloride	6.41E-009	6.12E-003	3.92E-011	1.30E-001	5.10E-012
Chloroform	1.82E-009	6.12E-003	1.12E-011	8.10E-002	9.03E-013
				Total	1.35E-009

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	6.08E-006	2.86E-001	1.74E-006	1.00E-002	1.74E-004
Barium	5.53E-007	2.86E-001	1.58E-007	1.40E-003	1.13E-004
Mercury (inorganic)	1.07E-007	2.86E-001	3.07E-008	5.10E-004	6.02E-005
Cadmium	1.84E-007	2.86E-001	5.27E-008	1.00E-002	5.27E-006
Nickel	1.35E-007	2.86E-001	3.87E-008	2.00E-002	1.94E-006
				Total	3.54E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	6.53E-007	6.12E-003	4.00E-009	1.00E-003	4.00E-006
Barium	5.94E-008	6.12E-003	3.63E-010	1.40E-004	2.59E-006
Mercury (inorganic)	1.15E-008	6.12E-003	7.05E-011	5.10E-005	1.38E-006
Cadmium	1.98E-008	6.12E-003	1.21E-010	1.00E-003	1.21E-007
Nickel	1.45E-008	6.12E-003	8.90E-011	2.00E-002	4.45E-009
				Total	8.10E-006

Table 7-34
Inhalation Risk Calculations - 6-year-old children
Including Only Chemicals Detected in the Stack
Residential Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.98E-008	1.67E-002	3.30E-010	6.10E+000	2.01E-009
Chromium VI	1.80E-009	1.67E-002	3.01E-011	4.10E+001	1.23E-009
HxCDF	1.32E-012	1.67E-002	2.20E-014	1.56E+004	3.45E-010
TeCDF	1.34E-013	1.67E-002	2.24E-015	1.56E+004	3.49E-011
Aldrin	7.67E-011	1.67E-002	1.28E-012	1.70E+001	2.18E-011
Methylene Chloride	6.18E-008	1.67E-002	1.03E-009	1.40E-002	1.44E-011
Carbon tetrachloride	6.41E-009	1.67E-002	1.07E-010	1.30E-001	1.39E-011
Chloroform	1.82E-009	1.67E-002	3.04E-011	8.10E-002	2.46E-012
				Total	3.68E-009

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	6.08E-006	7.81E-001	4.75E-006	1.00E-002	4.75E-004
Barium	5.53E-007	7.81E-001	4.32E-007	1.40E-003	3.08E-004
Mercury (inorganic)	1.07E-007	7.81E-001	8.38E-008	5.10E-004	1.64E-004
Cadmium	1.84E-007	7.81E-001	1.44E-007	1.00E-002	1.44E-005
Nickel	1.35E-007	7.81E-001	1.06E-007	2.00E-002	5.29E-006
				Total	9.67E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	6.53E-007	1.67E-002	1.09E-008	1.00E-003	1.09E-005
Barium	5.94E-008	1.67E-002	9.91E-010	1.40E-004	7.08E-006
Mercury (inorganic)	1.15E-008	1.67E-002	1.92E-010	5.10E-005	3.77E-006
Cadmium	1.98E-008	1.67E-002	3.30E-010	1.00E-003	3.30E-007
Nickel	1.45E-008	1.67E-002	2.43E-010	2.00E-002	1.21E-008
				Total	2.21E-005

Table 7-35
Oral Risk Calculations - Soil
Including Only Chemicals Detected in the Stack
Nearest Residential Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.88E-003	5.09E-007	9.55E-010	6.10E+000	5.82E-009
Chromium VI	1.71E-004	5.09E-007	8.70E-011	4.10E+001	3.57E-009
HxCDF	1.26E-007	5.09E-007	6.40E-014	1.56E+004	9.97E-010
TeCDF	1.27E-008	5.09E-007	6.00E-015	1.56E+004	1.01E-010
Aldrin	7.28E-006	5.09E-007	3.70E-012	1.71E+001	6.33E-011
				Total	1.06E-008

Hazard Index - Subchronic - Oral (Maximum Exposure -Child)

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Subchronic Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	6.19E-002	6.10E-006	3.78E-007	3.70E-002	1.02E-005
Mercury (inorganic)	1.09E-003	6.10E-006	6.66E-009	2.00E-003	3.33E-006
Cadmium	1.88E-003	6.10E-006	1.14E-008	1.00E-002	1.14E-006
Nickel	1.38E-003	6.10E-006	8.41E-009	2.00E-002	4.21E-007
Barium	5.63E-003	6.10E-006	3.43E-008	5.10E-001	6.73E-008
				Total	1.52E-005

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	1.88E-003	5.09E-007	9.55E-010	1.00E-003	9.55E-007
Copper	6.19E-002	5.09E-007	3.15E-008	3.70E-002	8.52E-007
Mercury (inorganic)	1.09E-003	5.09E-007	5.56E-010	2.00E-003	2.78E-007
Barium	5.63E-003	5.09E-007	2.86E-009	5.10E-002	5.62E-008
Nickel	1.38E-003	5.09E-007	7.02E-010	2.00E-002	3.51E-008
				Total	2.18E-006

Table 7-36
Oral Risk Calculations - Vegetables
Including Only Chemicals Detected in the Stack
Nearest Residential Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.51E-004	1.27E-006	1.92E-010	6.10E+000	1.17E-009
Chromium VI	1.38E-005	1.27E-006	1.75E-011	4.10E+001	7.18E-010
HxCDF	1.01E-008	1.27E-006	1.30E-014	1.56E+004	2.01E-010
TeCDF	1.03E-009	1.27E-006	1.31E-015	1.56E+004	2.04E-011
Aldrin	5.87E-007	1.27E-006	7.46E-013	1.71E+001	1.28E-011
				Total	2.12E-009

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	1.51E-004	1.27E-006	1.92E-010	1.00E-003	1.92E-007
Copper	5.00E-003	1.27E-006	6.34E-009	3.70E-002	1.71E-007
Mercury (inorganic)	8.81E-005	1.27E-006	1.12E-010	2.00E-003	5.59E-008
Barium	4.54E-004	1.27E-006	5.77E-010	5.10E-002	1.13E-008
Nickel	1.11E-004	1.27E-006	1.41E-010	2.00E-002	7.06E-009
				Total	4.38E-007

Table 7-37
Oral Risk Calculations - Vegetables
Maximum Exposure
Including Only Chemicals Detected in the Stack
Nearest Residential Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	1.51E-004	7.65E-006	1.16E-009	6.10E+000	7.07E-009
Chromium VI	1.38E-005	7.65E-006	1.05E-010	4.10E+001	4.33E-009
HxCDF	1.01E-008	7.65E-006	7.70E-014	1.56E+004	1.21E-009
TeCDF	1.03E-009	7.65E-006	8.00E-015	1.56E+004	1.23E-010
Aldrin	5.87E-007	7.65E-006	4.49E-012	1.71E+001	7.68E-011
				Total	1.28E-008

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	1.51E-004	7.65E-006	1.16E-009	1.00E-003	1.16E-006
Copper	5.00E-003	7.65E-006	3.82E-008	3.70E-002	1.03E-006
Mercury (inorganic)	8.81E-005	7.65E-006	6.74E-010	2.00E-003	3.37E-007
Barium	4.54E-004	7.65E-006	3.47E-009	5.10E-002	6.81E-008
Nickel	1.11E-004	7.65E-006	8.51E-010	2.00E-002	4.25E-008
				Total	2.64E-006

Table 7-38
Inhalation Risk Calculations - Adults
Including Only Chemicals Detected in the Stack
Irondale Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	3.81E-009	6.12E-003	2.33E-011	6.10E+000	1.42E-010
Chromium VI	3.47E-010	6.12E-003	2.12E-012	4.10E+001	8.70E-011
HxCDF	2.55E-013	6.12E-003	1.56E-015	1.56E+004	2.43E-011
TeCDF	2.60E-014	6.12E-003	1.59E-016	1.56E+004	2.48E-012
Aldrin	1.48E-011	6.12E-003	9.10E-014	1.70E+001	1.54E-012
Methylene Chloride	1.19E-008	6.12E-003	7.28E-011	1.40E-002	1.02E-012
Carbon tetrachloride	1.23E-009	6.12E-003	7.55E-012	1.30E-001	9.81E-013
Chloroform	3.51E-010	6.12E-003	2.15E-012	8.10E-002	1.74E-013
				Total	2.60E-010

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	4.36E-006	2.86E-001	1.25E-006	1.00E-002	1.25E-004
Barium	3.96E-007	2.86E-001	1.13E-007	1.40E-003	8.09E-005
Mercury (inorganic)	7.69E-008	2.86E-001	2.20E-008	5.10E-004	4.31E-005
Cadmium	1.32E-007	2.86E-001	3.78E-008	1.00E-002	3.78E-006
Nickel	9.70E-008	2.86E-001	2.78E-008	2.00E-002	1.39E-006
				Total	2.54E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	1.26E-007	6.12E-003	7.69E-010	1.00E-003	7.69E-007
Barium	1.14E-008	6.12E-003	6.99E-011	1.40E-004	4.99E-007
Mercury (inorganic)	2.22E-009	6.12E-003	1.36E-011	5.10E-005	2.66E-007
Cadmium	3.81E-009	6.12E-003	2.33E-011	1.00E-003	2.33E-008
Nickel	2.88E-009	6.12E-003	1.76E-011	2.00E-002	8.81E-010
				Total	1.56E-006

Table 7-39
Inhalation Risk Calculations - 6-year-old children
Including Only Chemicals Detected in the Stack
Irondale Receptors

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	3.81E-009	1.67E-002	6.36E-011	6.10E+000	3.88E-010
Chromium VI	3.47E-010	1.67E-002	5.79E-012	4.10E+001	2.37E-010
HxCDF	2.55E-013	1.67E-002	4.25E-015	1.56E+004	6.64E-011
TeCDF	2.60E-014	1.67E-002	4.34E-016	1.56E+004	6.77E-012
Aldrin	1.48E-011	1.67E-002	2.47E-013	1.70E+001	4.20E-012
Methylene Chloride	1.19E-008	1.67E-002	1.99E-010	1.40E-002	2.78E-012
Carbon tetrachloride	1.23E-009	1.67E-002	2.06E-011	1.30E-001	2.68E-012
Chloroform	3.51E-010	1.67E-002	5.86E-012	8.10E-002	4.74E-013
				Total	7.09E-010

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	4.36E-006	7.81E-001	3.40E-006	1.00E-002	3.40E-004
Barium	3.96E-007	7.81E-001	3.09E-007	1.40E-003	2.21E-004
Mercury (inorganic)	7.69E-008	7.81E-001	6.00E-008	5.10E-004	1.18E-004
Cadmium	1.32E-007	7.81E-001	1.03E-007	1.00E-002	1.03E-005
Nickel	9.70E-008	7.81E-001	7.58E-008	2.00E-002	3.79E-006
				Total	6.93E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	1.26E-007	1.67E-002	2.10E-009	1.00E-003	2.10E-006
Barium	1.14E-008	1.67E-002	1.91E-010	1.40E-004	1.36E-006
Mercury (inorganic)	2.22E-009	1.67E-002	3.70E-011	5.10E-005	7.26E-007
Cadmium	3.81E-009	1.67E-002	6.36E-011	1.00E-003	6.36E-008
Nickel	2.88E-009	1.67E-002	4.81E-011	2.00E-002	2.40E-009
				Total	4.25E-006

Table 7-40
Oral Risk Calculations - Soil
Including Only Chemicals Detected in the Stack
Irondale Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	6.53E-004	5.09E-007	3.32E-010	6.10E+000	2.03E-009
Chromium VI	5.95E-005	5.09E-007	3.03E-011	4.10E+001	1.24E-009
HxCDF	4.37E-008	5.09E-007	2.20E-014	1.56E+004	3.47E-010
TeCDF	4.44E-009	5.09E-007	2.00E-015	1.56E+004	3.52E-011
Aldrin	2.53E-006	5.09E-007	1.29E-012	1.71E+001	2.21E-011
				Total	3.67E-009

Hazard Index - Subchronic - Oral (Maximum Exposure -Child)

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Subchronic Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	2.16E-002	6.10E-006	1.32E-007	3.70E-002	3.55E-006
Mercury (inorganic)	3.80E-004	6.10E-006	2.32E-009	2.00E-003	1.16E-006
Cadmium	6.53E-004	6.10E-006	3.98E-009	1.00E-002	3.98E-007
Nickel	4.80E-004	6.10E-006	2.93E-009	2.00E-002	1.46E-007
Barium	1.96E-003	6.10E-006	1.20E-008	5.10E-001	2.34E-008
				Total	5.28E-006

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	6.53E-004	5.09E-007	3.32E-010	1.00E-003	3.32E-007
Copper	2.16E-002	5.09E-007	1.10E-008	3.70E-002	2.97E-007
Mercury (inorganic)	3.80E-004	5.09E-007	1.94E-010	2.00E-003	9.68E-008
Barium	1.96E-003	5.09E-007	9.98E-010	5.10E-002	1.96E-008
Nickel	4.80E-004	5.09E-007	2.44E-010	2.00E-002	1.22E-008
				Total	7.58E-007

Table 7-41
Oral Risk Calculations - Vegetables
Including Only Chemicals Detected in the Stack
Irondale Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	5.27E-005	1.27E-006	6.69E-011	6.10E+000	4.08E-010
Chromium VI	4.80E-006	1.27E-006	6.10E-012	4.10E+001	2.50E-010
HxCDF	3.53E-009	1.27E-006	4.00E-015	1.56E+004	6.99E-011
TeCDF	3.58E-010	1.27E-006	4.55E-016	1.56E+004	7.09E-012
Aldrin	2.04E-007	1.27E-006	2.60E-013	1.71E+001	4.44E-012
				Total	7.40E-010

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	5.27E-005	1.27E-006	6.69E-011	1.00E-003	6.69E-008
Copper	1.74E-003	1.27E-006	2.21E-009	3.70E-002	5.97E-008
Mercury (inorganic)	3.07E-005	1.27E-006	3.90E-011	2.00E-003	1.95E-008
Barium	1.58E-004	1.27E-006	2.01E-010	5.10E-002	3.94E-009
Nickel	3.87E-005	1.27E-006	4.92E-011	2.00E-002	2.46E-009
				Total	1.53E-007

Table 7-42
Oral Risk Calculations - Vegetables
Maximum Exposure
Including Only Chemicals Detected in the Stack
Irondale Receptors

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	5.27E-005	7.65E-006	4.03E-010	6.10E+000	2.46E-009
Chromium VI	4.80E-006	7.65E-006	3.67E-011	4.10E+001	1.51E-009
HxCDF	3.53E-009	7.65E-006	2.70E-014	1.56E+004	4.21E-010
TeCDF	3.58E-010	7.65E-006	3.00E-015	1.56E+004	4.27E-011
Aldrin	2.04E-007	7.65E-006	1.56E-012	1.71E+001	2.68E-011
				Total	4.46E-009

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	5.27E-005	7.65E-006	4.03E-010	1.00E-003	4.03E-007
Copper	1.74E-003	7.65E-006	1.33E-008	3.70E-002	3.60E-007
Mercury (inorganic)	3.07E-005	7.65E-006	2.35E-010	2.00E-003	1.17E-007
Barium	1.58E-004	7.65E-006	1.21E-009	5.10E-002	2.37E-008
Nickel	3.87E-005	7.65E-006	2.96E-010	2.00E-002	1.48E-008
				Total	9.19E-007

Table 7-43
Inhalation Risk Calculations - Adults
Including Only Chemicals Detected in the Stack
Hanson School

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	2.94E-009	6.12E-003	1.80E-011	6.10E+000	1.10E-010
Chromium VI	2.67E-010	6.12E-003	1.64E-012	4.10E+001	6.71E-011
HxCDF	1.96E-013	6.12E-003	1.00E-015	1.56E+004	1.87E-011
Carbon tetrachloride	9.51E-009	6.12E-003	5.82E-011	1.30E-001	7.56E-012
TeCDF	2.00E-014	6.12E-003	1.22E-016	1.56E+004	1.91E-012
Aldrin	1.14E-011	6.12E-003	7.00E-014	1.70E+001	1.19E-012
Methylene Chloride	9.17E-009	6.12E-003	5.61E-011	1.40E-002	7.86E-013
Chloroform	2.70E-010	6.12E-003	1.66E-012	8.10E-002	1.34E-013
				Total	2.07E-010

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	3.13E-006	2.86E-001	8.95E-007	1.00E-002	8.95E-005
Barium	2.84E-007	2.86E-001	8.13E-008	1.40E-003	5.81E-005
Mercury (inorganic)	5.52E-008	2.86E-001	1.58E-008	5.10E-004	3.09E-005
Cadmium	9.48E-008	2.86E-001	2.71E-008	1.00E-002	2.71E-006
Nickel	6.96E-008	2.86E-001	1.99E-008	2.00E-002	9.96E-007
				Total	1.82E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	9.69E-008	6.12E-003	5.93E-010	1.00E-003	5.93E-007
Barium	8.81E-009	6.12E-003	5.39E-011	1.40E-004	3.85E-007
Mercury (inorganic)	1.71E-009	6.12E-003	1.05E-011	5.10E-005	2.05E-007
Cadmium	2.94E-009	6.12E-003	1.80E-011	1.00E-003	1.80E-008
Nickel	2.16E-009	6.12E-003	1.32E-011	2.00E-002	6.60E-010
				Total	1.20E-006

Table 7-44
Inhalation Risk Calculations - 6-year-old children
Including Only Chemicals Detected in the Stack
Hanson School

Carcinogenic Risk - Inhalation

Chemical Carcinogens	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	2.94E-009	1.67E-002	4.90E-011	6.10E+000	2.99E-010
Chromium VI	2.67E-010	1.67E-002	4.46E-012	4.10E+001	1.83E-010
HxCDF	1.96E-013	1.67E-002	3.27E-015	1.56E+004	5.11E-011
Carbon tetrachloride	9.51E-009	1.67E-002	1.59E-010	1.30E-001	2.06E-011
TeCDF	2.00E-014	1.67E-002	3.34E-016	1.56E+004	5.21E-012
Aldrin	1.14E-011	1.67E-002	1.90E-013	1.70E+001	3.23E-012
Methylene Chloride	9.17E-009	1.67E-002	1.53E-010	1.40E-002	2.14E-012
Chloroform	2.70E-010	1.67E-002	4.52E-012	8.10E-002	3.66E-013
				Total	5.65E-010

Hazard Index - Inhalation - Subchronic (8 Hour)

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Daily Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	3.13E-006	7.81E-001	2.44E-006	1.00E-002	2.44E-004
Barium	2.84E-007	7.81E-001	2.22E-007	1.40E-003	1.59E-004
Mercury (inorganic)	5.52E-008	7.81E-001	4.31E-008	5.10E-004	8.45E-005
Cadmium	9.48E-008	7.81E-001	7.40E-008	1.00E-002	7.40E-006
Nickel	6.96E-008	7.81E-001	5.44E-008	2.00E-002	2.72E-006
				Total	4.98E-004

Hazard Index - Inhalation - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration mg/m3	Lifetime Inhalation Intake Factor m3/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Copper	9.69E-008	1.67E-002	1.62E-009	1.00E-003	1.62E-006
Barium	8.81E-009	1.67E-002	1.47E-010	1.40E-004	1.05E-006
Mercury (inorganic)	1.71E-009	1.67E-002	2.85E-011	5.10E-005	5.60E-007
Cadmium	2.94E-009	1.67E-002	4.90E-011	1.00E-003	4.90E-008
Nickel	2.16E-009	1.67E-002	3.60E-011	2.00E-002	1.80E-009
				Total	3.28E-006

Table 7-45
Oral Risk Calculations - Soil
Including Only Chemicals Detected in the Stack
Hanson School

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	3.98E-004	5.09E-007	2.02E-010	6.10E+000	1.23E-009
Chromium VI	3.62E-005	5.09E-007	1.84E-011	4.10E+001	7.56E-010
HxCDF	2.66E-008	5.09E-007	1.40E-014	1.56E+004	2.11E-010
TeCDF	2.70E-009	5.09E-007	1.37E-015	1.56E+004	2.14E-011
Aldrin	1.54E-006	5.09E-007	7.85E-013	1.71E+001	1.34E-011
				Total	2.24E-009

Hazard Index - Subchronic - Oral (Maximum Exposure -Child)

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Subchronic Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Subchronic Exposure mg/kg/day	Hazard Index
Copper	1.31E-002	6.10E-006	8.01E-008	3.70E-002	2.16E-006
Mercury (inorganic)	2.32E-004	6.10E-006	1.41E-009	2.00E-003	7.06E-007
Cadmium	3.98E-004	6.10E-006	2.43E-009	1.00E-002	2.43E-007
Nickel	2.92E-004	6.10E-006	1.78E-009	2.00E-002	8.91E-008
Barium	1.19E-003	6.10E-006	7.28E-009	5.10E-001	1.43E-008
				Total	3.22E-006

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Soil mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	3.98E-004	5.09E-007	2.02E-010	1.00E-003	2.02E-007
Copper	1.31E-002	5.09E-007	6.68E-009	3.70E-002	1.81E-007
Mercury (inorganic)	2.32E-004	5.09E-007	1.18E-010	2.00E-003	5.89E-008
Barium	1.19E-003	5.09E-007	6.07E-010	5.10E-002	1.19E-008
Nickel	2.92E-004	5.09E-007	1.49E-010	2.00E-002	7.44E-009
				Total	4.61E-007

Table 7-46
Oral Risk Calculations - Vegetables
Including Only Chemicals Detected in the Stack
Hanson School

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	3.21E-005	1.27E-006	4.08E-011	6.10E+000	2.49E-010
Chromium VI	2.92E-006	1.27E-006	3.71E-012	4.10E+001	1.52E-010
HxCDF	2.15E-009	1.27E-006	3.00E-015	1.56E+004	4.26E-011
TeCDF	2.18E-010	1.27E-006	2.77E-016	1.56E+004	4.32E-012
Aldrin	1.25E-007	1.27E-006	1.58E-013	1.71E+001	2.70E-012
				Total	4.50E-010

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	3.21E-005	1.27E-006	4.08E-011	1.00E-003	4.08E-008
Copper	1.06E-003	1.27E-006	1.34E-009	3.70E-002	3.63E-008
Mercury (inorganic)	1.87E-005	1.27E-006	2.37E-011	2.00E-003	1.19E-008
Barium	9.63E-005	1.27E-006	1.22E-010	5.10E-002	2.40E-009
Nickel	2.36E-005	1.27E-006	2.99E-011	2.00E-002	1.50E-009
				Total	9.29E-008

Table 7-47
Oral Risk Calculations - Vegetables
Maximum Exposure
Including Only Chemicals Detected in the Stack
Hanson School

Carcinogenic Risk - Oral

Chemical Carcinogens	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Carcinogenic Potency Factor (mg/kg/day)-1	Carcinogenic Risk
Cadmium	3.21E-005	7.65E-006	2.45E-010	6.10E+000	1.50E-009
Chromium VI	2.92E-006	7.65E-006	2.24E-011	4.10E+001	9.17E-010
HxCDF	2.15E-009	7.65E-006	1.60E-014	1.56E+004	2.56E-010
TeCDF	2.18E-010	7.65E-006	2.00E-015	1.56E+004	2.60E-011
Aldrin	1.25E-007	7.65E-006	9.52E-013	1.71E+001	1.63E-011
				Total	2.71E-009

Hazard Index - Oral - Chronic

Chemical (Non-Carcinogens)	Chemical Concentration in Vegetables mg/kg	Lifetime Oral Intake Factor kg/kg/day	Daily Intake mg/kg/day	Acceptable Intake Chronic Exposure mg/kg/day	Hazard Index
Cadmium	3.21E-005	7.65E-006	2.45E-010	1.00E-003	2.45E-007
Copper	1.06E-003	7.65E-006	8.10E-009	3.70E-002	2.19E-007
Mercury (inorganic)	1.87E-005	7.65E-006	1.43E-010	2.00E-003	7.15E-008
Barium	9.63E-005	7.65E-006	7.36E-010	5.10E-002	1.44E-008
Nickel	2.36E-005	7.65E-006	1.80E-010	2.00E-002	9.02E-009
				Total	5.59E-007

8.0 CONCLUSIONS

This public health risk assessment was performed according to SPHEM guidance and evaluated the carcinogenic and noncarcinogenic health risks for five receptor populations. These populations were:

- On-site workers in the maximum impact area
- Members of the public who were assumed to spend their entire lifetime at the portion of fenceline that has the highest impact
- The most highly impacted residential area
- Irondale
- Hanson School, the school that was impacted the greatest

The noncarcinogenic health risk is expressed in terms of a hazard index. Whenever the hazard index is less than 1.0, there is no cause for concern. A hazard index was calculated for chronic exposures and sub-chronic exposures. The highest hazard index calculated was 1.45E-03 (on-site workers) and lower values were determined for all other populations. This demonstrates that there are no noncarcinogenic health risks associated with the incineration of Basin F liquid.

Carcinogenic health risks in this report are expressed as an individual's increased risk of contracting cancer. According to EPA policy the target total individual risk resulting from exposures at a Superfund site may range anywhere between 1.0E-04 to 1.0E-07. Thus, remedial alternatives (at a Superfund Site) should be able to reduce total potential carcinogenic risks to individuals to levels within this range. Although a 1.0E-06 cancer risk (one excess cancer per million people) is not a defacto standard, it is generally used by agencies as an acceptable cancer risk.

The maximum cancer risk for off-site populations in this study was 6.84E-08, or less than 7 excess cancers for each one hundred million people. The cancer risk for on-site workers was determined to be 4.55E-07, which is less than the U.S. EPA policy range for an acceptable risk.

It is concluded from this public health risk assessment that submerged quench incineration of Basin F liquids at the Rocky Mountain Arsenal site does not pose an unacceptable cancer risk, according to EPA policy and other government agencies (Paustenbach).

9.0 LIMITATIONS AND SENSITIVITY ANALYSIS

The objective of this section of the report is to identify and discuss various issues, assumptions, and data that may have limited the assessment of the health risks or may have resulted in an underestimation or overestimation of the actual risk. There are always uncertainties associated with assumptions that are made in the absence of data. In order that the health risks are not underestimated, conservative assumptions are made. The result is that the conservative assumptions are usually compounded on each other resulting in an overestimate of the actual risk. In preparing this report, assumptions were made which could overstate or understate the actual risk. These are discussed below:

Factors which may understate risk:

- A dermal exposure route was not evaluated. Contaminated soil adhering to the skin or particulate deposition directly on the skin might result in increased exposure and risk. Although this route can be significant for workers handling wastes, it was judged not to be significant compared to other exposure routes potentially experienced by the public in the RMA exposure scenario.

- Secondary exposure routes were not evaluated. An example is the human consumption of beef or chickens which are raised in potentially exposed areas. The low concentrations of contaminants deposited on the soil and plants would result in a relatively insignificant increase in human exposure compared to the routes evaluated.

- The absorption of contaminants from garden soil by vegetable routes was not evaluated, nor was the absorption of contaminants through the leaves of vegetables. The very low concentration of

contaminants in garden soil after tilling and the fact that the indicator chemicals are not particularly mobile through plant leaves, means that the resulting exposure levels would be very low and the resulting health risk would be low compared to the exposure routes evaluated.

- The deposition of particulate onto surface water or onto soil and then leached into ground water and subsequent human ingestion was not evaluated. The impact of this exposure route is very small compared to the exposure routes evaluated in this risk assessment.

Factors which may overstate risk:

- The U.S. EPA indicates that the use of this overall approach to evaluate health risks may overstate the risk and that the actual risk may be zero.

- The carcinogenic potency of arsenic is currently undergoing U.S. EPA review by their Science Advisory Board. They have suggested that a threshold exists for arsenic metabolism which would reduce the risks at low exposure levels.

- The inhalation exposure pathway assumed that all released particulate matter was airborne and available for inhalation.

- Soil and vegetable ingestion pathways assumed that all released particulate matter was deposited on the soil or vegetables.

- Even though dioxins and furans were not detected in the stack gas they were assumed to be emitted at detection limit concentrations and were assumed to be present as the most toxic isomer.

- The U.S. EPA has under review a reduced potency value for TCDD. Since the other dioxin and furan potencies are derived from the TCDD potency, any reduction in the potency value will result in a reduced risk. It is also important to note that even after much intense study, that there is no conclusive evidence that dioxins are human carcinogens.

- Dieldrin was not detected in the stack gas but was assumed to be present at detection levels for the risk assessment.

- The choice of leaf lettuce as the "generic" garden vegetable in this risk assessment overstates the actual exposure. This is discussed below in more detail.

- The use of home grown vegetables year round is not typical and overestimates the potential health risk.

- The actual location of the incinerator has not been finalized. Other tentative locations, besides near Basin F which was assumed in this risk assessment, would be more distant from the receptor populations evaluated and as such would result in lower predicted health risks.

The choice of leaf lettuce as the model vegetable is a conservative assumption that will not understate the potential risk from this exposure pathway. Lettuce has the highest surface area of all garden vegetables and is not generally canned or frozen for year-round use. The following discussion compares the relative contamination a variety of garden vegetables would receive compared to leaf lettuce.

An examination of vegetables and their potential susceptibility to pollution from particulate deposition is facilitated by grouping the vegetables by susceptibility to particulate deposition. The first group of

vegetables grow underground such as carrots, beets and potatoes. The edible portions (except for beet greens) are not susceptible to particulate deposition. Second, there are vegetables such as corn, shell peas, head lettuce, cabbage, and shell beans in which the outer cover is generally removed in either the harvest or preparation process. Third, there are exposed vegetables that are eaten after some level of preparation. These include tomatoes, peppers, broccoli, and cauliflower. This group includes the leafy vegetables, usually with a short growing period, such as leaf lettuce, spinach, collards, and Swiss chard.

It can readily be concluded from the above discussion that the use of leaf lettuce as the modeled vegetable will not underestimate subsequent health risks.

10.0 REFERENCES

Agency for Toxic Substances and Disease Registry (ASTDR), 1988, Draft Toxicological Profiles, 25-vol. set.

Anderson, E., et al., 1984, Development of Statistical Distributions or Ranges of Standard Factors Used In Exposure Assessments, Draft Report Prepared for U.S. EPA, Contract 68-02-3510.

Galloway, N.N., Eisenreich, S.J., and Scott, B., 1980, Toxic Substances in Atmospheric Deposition: A Review and Assessment, Report of Workshop Held at Jekyll Island, Georgia, November 13-16, 1979, National Oceanic and Atmospheric Administration, U.S. Environmental Protection Agency, and National Acid Deposition Program.

Holzworth, G.C., 1972, Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States, U.S. Environmental Protection Agency, Office of Air Programs, Research Triangle Park, NC.

National Institute of Occupational Safety and Health (NIOSH), 1985, NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, DHEW Publication No. 78-210, Fifth Printing, Washington, D.C.

National Oceanic and Atmospheric Administration, 1988, ALOHA - Areal Locations of Hazardous Atmospheres, Version 4.0, User's Manual, Modeling and Simulation Studies, Hazardous Materials Response Branch, Seattle, WA.

Paustenbach, D.J., 1989, The Risk Assessment of Environmental and Human Health Hazards: A textbook of case studies, John Wiley & Sons.

Poiger, H., and Schlatter, C.H., 1979, Influence of Solvents and Adsorbents on Dermal and Intestinal Absorption of TCDD, Food Cosmet. Toxicol., v. 18, p. 477-481.

U.S. Environmental Protection Agency (EPA), 1980, Dietary Consumption of Selected Food Groups for the U.S. Population, PPB 1-147035.

U.S. Environmental Protection Agency, 1985, Compilation of Air Pollutant Emission Factors, Vol. I: Stationary Point and Area Sources, Office of Air and Radiation, AP-42, South Ed., Research Triangle Park, NC.

U.S. Environmental Protection Agency, 1986, Superfund Public Health Evaluation Manual (SPHEM), EPA 540/1-86/060, OSWER Directive 9285.4-1.

U.S. Environmental Protection Agency, 1987, Industrial Source Complex (ISC) Dispersion Model User's Guide - Second Edition (Revised), Vol. I, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

U.S. Environmental Protection Agency, 1988a, Superfund Exposure Assessment Manual (SEAM), EPA/540/1-88/001, OSWER Directive 9285.5-1.

U.S. Environmental Protection Agency - Region IX, 1988b, Recommended Procedures for Implementation of Superfund Risk Assessment Guidelines, Gerald F. S. Hiatt, Ph.D., Regional Expert Toxicologist.

U.S. Environmental Protection Agency, 1989, Exposure Factors Handbook, EPA/600/8-89/043.

11.0
ABBREVIATIONS USED

H_xCDD = Hexachlorodibenzo-p-dioxin
H_xCDF = Hexachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
PeCDD = Pentachlorodibenzo-p-dioxin
SQI = Submerged Quench Incineration
TCDD = Tetrachlorodibenzo-p-dioxin
TeCDF = Tetrachlorodibenzofuran